BY THE SAME AUTHOR

THE REALM OF ENDS
OR
PLURALISM AND THEISM

THE GIFFORD LECTURES
Delivered in the University of St. Andrews
in the years 1907–10

Second Edition. 1912

HEREDITY AND MEMORY

SIDGWICK MEMORIAL LECTURE, 1913

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NATURALISM

AND

AGNOSTICISM

THE GIFFORD LECTURES DELIVERED BEFORE
THE UNIVERSITY OF ABERDEEN
IN THE YEARS 1896–1898

BY

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FOURTH EDITION

"*Wer die Gesetzmässigkeit der Natur für das verantwortlich macht, was wirklich geschieht, behauptet damit, dass sie Gedanken realisiere, und ist Teleolog ohne es zu wissen.*"—SIGWART.

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PREFACE TO THE FOURTH EDITION

BESIDES making numerous small emendations I have added to this edition about a dozen explanatory notes. Further, in order to get the whole more easily into one volume, the detailed table of contents has been omitted.

In a second course of Gifford Lectures delivered at St. Andrews in 1907-10, entitled *The Realm of Ends* or *Pluralism and Theism*, I have tried to meet 'the wish frequently expressed,' and mentioned here in the preface of the second edition—to advance, that is to say, beyond 'the threshold of Spiritualistic Monism, and to discuss the relation of God as the Supreme Mind to finite minds.' In view of the whole, a better title for the present course would perhaps have been *The Realm of Nature* or *Naturalism and Spiritualism.*

JAMES WARD.

TRINITY COLLEGE, CAMBRIDGE,
July 1914.

PREFACE TO THE SECOND EDITION

THOUGH the first edition of this work was exhausted more than a year ago, my engagements have prevented me till recently from completing such revision as seemed essential to the issue of a second. Besides making numerous corrections and emendations in the text, suggested by various reviewers and correspondents, I have added at the end of each volume a number of 'Explanatory Notes,' dealing chiefly with controverted points. In a Supplementary Note to Part I. I have endeavoured to reply to the defence of 'physical realism' advanced by Sir Arthur Rücker in his Presidential Address to the British Association in 1901.

The wish has been frequently expressed that, instead of stopping short on the threshold of Spiritualistic Monism, I had proceeded to discuss the relation of God as the Supreme Mind to finite minds. When I began to write these lectures, eight years ago, I planned to devote the second course to the subject of *Optimism and Pessimism* and to find in this an opportunity for a full discussion of the problem of the One and the Many in its most important aspects. But my first topic, *Naturalism and Agnosticism*, proved too unwieldy, and gradually absorbed all the time and space at my command. After the publication of the first edition I still had thoughts of writing one or two

lectures dealing with this problem to be added to a second edition, should one be called for. But the said lectures are still unwritten and the writing would take me long. Meanwhile several important works have appeared devoted chiefly or entirely to this problem,[1] and I now feel that such cursory treatment as I contemplated would be out of place and unsatisfactory: out of place, because, after all, my main purpose was to deal with what I have called 'the demurrer' of the scientific spirit of the age to theism altogether; and unsatisfactory, because it is plain that any adequate treatment of so large a question cannot be brief. So I must revert to my original plan and rest content with the hope that in the future I may have time and strength to accomplish it.

JAMES WARD.

TRINITY COLLEGE, CAMBRIDGE,
May 1903.

[1] I refer especially to the two volumes, *The World and The Individual* (1900-1901), by my successor in the Gifford Lectureship at Aberdeen, Professor Royce of Harvard; also to Professor Howison's *Limits of Evolution* (1901), Dr. M'Taggart's *Studies in Hegelian Cosmology* (1901), Professor James's *Varieties of Religious Experience* (1902), and M. Renouvier's *Le Personnalisme* (1903).

PREFACE TO FIRST EDITION

THESE lectures do not form a systematic treatise. They only attempt to discuss in a popular way certain assumptions of 'modern science' which have led to a widespread, but more or less tacit, rejection of idealistic views of the world. These assumptions are, of course, no part of the general body of the natural sciences, but rather prepossessions that, after gradually taking shape in the minds of many absorbed in scientific studies, have entered into the current thought of our time. Though, as I believe, these prepossessions will prove to be ill-grounded and mistaken, yet they are nevertheless the almost inevitable outcome of the standpoint and the premisses from which the natural sciences start. If with the history of science and the results of science before us we pass straight on to the construction of a philosophy, idealism has no chance. But, in truth, 'modern science' hardly needs to *construct* its philosophy; for, without any conscious labour on its part, the naturalistic view of the world seems to stand out clearly of itself. Figuratively speaking we have, as it were, the nebular hypothesis exemplified in the evolution of knowledge. (And for Mr. Spencer, by the way, the exemplification is more than figurative.) From an inchoate confusion of *Glaube* and *Aberglaube*, of probable opinions and fan-

ciful surmises, there gradually emerges the clear circle of the sciences, waxing brighter as it advances in coherence and continuity, while the void of nescience beyond grows too dark for shadows, too empty for dreams; till at length all there is to know finds a place in an unbroken concatenation of laws, binding nature fast in fate. Taking science as the touchstone of knowledge, "knowing in the strict sense," as Mr. Spencer calls it, we must admit that we do not know God or even see room for God at all. Such is the naturalistic contrast of science and nescience, on the strength of which Naturalism takes Agnosticism for an ally. But the agnostic opposition of knowable and unknowable is by no means identical with this contrast; and the alliance is proving ill-starred in consequence. For the distinction of known and unknown, as science intends it, is, we may say, a mere objective distinction of fact; the distinction of knowable and unknowable as used by the agnostic, on the other hand, brings the knower himself to the fore, and entails an examination both of the standpoint and of the premisses from which science, without any preliminary criticism, set forth. In other words, Naturalism is essentially dogmatic, whereas Agnosticism is essentially sceptical.

But this strange *liaison*, though disastrous to Naturalism, has served to promote Idealism in sundry ways. The old materialism has been repudiated and an agnostic or neutral monism — nihilism some would call it — has come into vogue in its stead. 'Modern Science' seems at this point in a dilemma; either this nondescript monism must lapse back into materialism or move on to spiritualism. But the relapse is difficult and the present

position unstable. With these more strictly epistemological topics I have tried to deal in the second and shorter half of this work (beginning, that is, with *Lecture XIV*). Many who chance to glance at its contents, especially if they should be students of philosophy, may think that here was the place to begin, and that the earlier and longer division of the book could be suppressed without much detriment to the justification of idealism that follows. That the one half might have been expanded and the other contracted with advantage, I fully admit; and had it been any way practicable to recast lectures, delivered on five separate occasions, into one whole, such a readjustment might have been effected. But, in any case, it would have seemed essential to the writer's argument and purpose to discuss what have been called the real principles of Naturalism at some length.

I take it for granted that till an idealistic (*i.e.* spiritualistic) view of the world can be sustained, any exposition of theism is but wasted labour. Such, at any rate, is the opinion of those who are dominated by naturalistic preconceptions, and that — so far as these discussions are concerned — is sufficient. But now, as already said, it is precisely 'the solid ground of nature' science seems to present that makes idealism appear to the naturalist so fatuous or so futile, 'containing nothing but sophistry and illusion, leading to nothing but obscurity and confusion of ideas.' But is it verily positive, fully orbed reality that modern science sets before us? This is the question that leads us to examine the mechanical theory, the theory of evolution and the theory of psychical epiphenomena, the principles on which this supposed

unity and completeness seem mainly to depend. Naturalism, we find, though rejecting materialism, abandons neither the materialistic standpoint nor the materialistic endeavour to colligate the facts of life, mind, and history with a mechanical scheme. But the compact of Naturalism with Agnosticism, like the legendary compacts with the devil, to which Lange happily compares it, costs Naturalism, as it turns out, its entire philosophical existence. In order to be free of 'metaphysical quagmires' such as the ideas of substance and cause, it is led to reject the reality not only of mind, but even of matter; and in this state of ideophobia must collapse, for lack of the very ideas it dreads.

The following is a brief outline of the argument:—

A. i. Mechanics, as a branch of mathematics dealing simply with the quantitative aspects of physical phenomena, can dispense entirely with 'real categories'; not so the mechanical theory of Nature, which aspires to resolve the actual world into an actual mechanism. Homœopathic remedies are the best for that disorder; and, in fact, at the present time mathematicians are, of all men of science, the least tainted with it. An inquiry into the character and mutual relations of Abstract Dynamics, Molar Mechanics, and Molecular Mechanics, seems to shew that the modern dream of a mechanical ἀρχὴ is as wild as the Pythagorean of an arithmetical one. (*Lectures II–VI.*) ii. A powerful, though unintentional refutation of this theory is furnished by Mr. Herbert Spencer's attempt to base a philosophy of evolution on the doctrine of the conservation of energy. When at length Naturalism is forced to take account of the facts of life and mind, we

find the strain on the mechanical theory is more than it will bear. Mr. Spencer has blandly to confess that 'two volumes' of his 'Synthetic Philosophy' are missing, the volumes that should connect inorganic with biological, evolution. (*Lectures VII–IX.*) Turning to the great work of Darwin, we find, on the one hand, no pretence at even conjecturing a mechanical derivation of life;[1] and, on the other, we find teleological factors, implicating mind and incompatible with mere mechanism, regarded as indispensable. (*Lecture X.*) iii. And finally, when confronted with the relation of mind and body, Naturalism is driven, in the endeavour to maintain its mechanical basis inviolable, to broach psychophysical theories in flagrant contradiction not only with sound mechanical principles and sound logic, but with the plain facts of daily experience. To the body as a phenomenal machine corresponds the mind as an epiphenomenal machine, albeit the correspondence cannot be called causal in any physical sense, nor casual in any logical sense. (*Lectures XI–XIII.*)

B. An examination of the 'real principles' of Naturalism thus secures us a specially advantageous position for discussing the epistemological questions on which the justification of idealism depends. iv. The dualism of matter and mind, which has made the connexion of body and soul an enigma for the naturalist, has rendered the converse problem, as to the perception of an external world, equally vexatious to the psychologist. It is obvious that

[1] "It is mere rubbish thinking at present of the origin of life; one might as well think of the origin of matter." —Letter to Hooker, *Darwin's Life*, vol. iii, p. 18.

there is no such dualism in experience itself, with which we must begin; and reflecting upon experience as a whole, we learn how such dualism has arisen: also we see that it is false. (*Lectures XIV–XVII.*) Further, such reflexion shews that the unity of experience cannot be replaced by an unknowable that is no better than a gulf between two disparate series of phenomena and epiphenomena. Once materialism is abandoned and dualism found untenable, a spiritualistic monism remains the one stable position. It is only in terms of mind that we can understand the unity, activity, and regularity that nature presents. In so understanding we see that Nature is Spirit. (*Lectures XVIII–XX.*)

It is to be feared that inconsistencies and misunderstandings may be detected in the course of an argument elaborated piecemeal over a period of three years, and continually interrupted by other work. Some of these I might myself have discovered had it been possible to do more than publish the lectures substantially as they were delivered.

JAMES WARD.

TRINITY COLLEGE, CAMBRIDGE,
March 1899.

CONTENTS

Introduction

Part V. Spiritualistic Monism

NATURALISM AND AGNOSTICISM

LECTURE I

INTRODUCTION

The attitudes towards Theism of Newton and Laplace: the latter has become the common attitude of 'Science.' This illustrated.

The polity of Modern Science claims to be in idea a complete and compacted whole. 'Gaps,' in what sense admitted, and how dealt with.

The dualism of Matter and Mind: 'Science' decides to treat the former as fundamental, the latter as episodic.

Professor Huxley on the situation: his admissions and advice — a blend of Naturalism and Agnosticism. These doctrines complementary: they react upon each other. According to the one, Natural Theology is unnecessary; according to the other, Rational Theology is impossible.

Examination of the position that Science forms a self-contained whole. No sharp boundary between 'science and nescience.' Mr. Spencer betrays science.

Tyndall's suggestion of an Emotional Theology.

SIR ISAAC NEWTON concludes his famous *Principia* with a general scholium, in which he maintains that "the whole diversity of natural things can have arisen from nothing but the ideas and the will of one necessarily existing being, who is always and everywhere, God Supreme, infinite, omnipotent, omniscient, absolutely perfect." A little more than a hundred years later Laplace began to publish his *Mécanique Céleste*, which may be described as an extension of Newton's *Principia* on

Newton's lines, translated into the language of the differential calculus. When Laplace went to make a formal presentation of his work to Napoleon, the latter remarked: "M. Laplace, they tell me you have written this large book on the system of the universe and have never even mentioned its Creator." Whereupon Laplace drew himself up and answered bluntly: "Sire, I had no need of any such hypothesis."[1] Since that interview another century has almost passed. Sciences that were then in their infancy—such as chemistry, geology, biology, and even psychology—have in the meantime attained imposing proportions. Any one who might now have the curiosity to compare the treatises of their best attested exponents with the great work of Laplace would find that work no longer singular in the omission which Napoleon found so remarkable, an omission which Newton, by the way, in his famous letters to Bentley, had already pronounced to be absurd.

Of course, it is not to be forgotten, the increasing specialisation brought about by the growth of knowledge justifies and even necessitates far greater restriction in the scope of any given branch of it than was customary a couple of centuries ago. People talked then, not of this or that natural science, but of 'natural philosophy'; and psychology, as we know, even in our own day, is often lumped together with metaphysics as 'mental philosophy.' It was incumbent on men styling themselves philosophers to define their attitude towards the notions of a necessarily existent Being, a First and Absolute Cause, and not to confine themselves merely to contin-

[1] W. W. Rouse Ball, *Short History of Mathematics*, 1888, p. 388.

gent existences and to causes that are in turn conditioned. The sharp division which Christian Wolff brought into vogue between empirical and rational knowledge was then ignored, if not unknown. But nowadays, at all events, the absence from a work on natural science of all reference to the supernatural would be no proof that the author disavowed the supernatural altogether.

Still, this is not the point. What we have to note is the existence in our time of a vast circle of empirical knowledge in the whole range of which the idea of a Necessary Being or a First Cause has no place. Towards this result religious and devout men like Cuvier or Faraday have contributed as much as atheists such as Holbach or Laplace. Like many another result of collective human effort, it was neither intended nor foreseen. But there it is nevertheless; and it is all the more impressive because it has grown with humanity, and is not the work of a one-sided sect or school. If modern science had a voice and were questioned as to this omission of all reference to a Creator, it would only reply: I am not aware of needing any such hypothesis.

God made the country, they say, and man made the town. Now we may, as Descartes did, compare science to the town. It is town-like in its compactness and formality, in the preëminence of number and measurement, systematic connexion, and constructive plan. And where science ends, they say too, philosophy and faith may begin. But where *is* science to end? All was country once, but meanwhile the town extends and extends, and the country seems to be ever receding before it. Let us recall a few familiar instances by way of illustration.

To Bentley's inquiry, how the movements and structure of the solar system were to be accounted for, Newton replied: "To your query I answer that the motions which the planets now have could not spring from any natural cause alone, but were impressed by an intelligent Agent. . . . To make this system with all its motions required a cause which understood and compared together the quantities of matter in the several bodies of the sun and planets and the gravitating powers resulting from thence, . . . and to compare and adjust all these things together in so great a variety of bodies, argues that cause to be not blind and fortuitous, but very well skilled in mechanism and geometry."[1] But now, in place of this direct intervention of an intelligent Agent, modern astronomy substitutes the nebular hypothesis of Kant and Laplace. Think again of the remarkable instances of special contrivance and design collected by Paley in his *Natural Theology*, published at the beginning of this century, or of those of the *Bridgewater Treatises* a generation later — works from which some of us perhaps got our first knowledge of science. Nobody reads these books now, and nobody writes others like them. Such arguments have ceased to be edifying, or even safe, since they cut both ways, as the formidable array of facts capable of an equally cogent dysteleological application sufficiently shews. But, in truth, special adaptations have ceased to lie on the confines of science, where natural causes end. "Sturmius," says Paley, "held that the examination of the eye was a cure for atheism."[2] Yet Helm-

[1] Bentley's *Works*, Dyce's edition, vol. iii, pp. 204–206.

[2] *Natural Theology*, ch. iii, Tegge's edition of the *Works*, p. 263.

holtz, who knew incomparably more about the eye than half a dozen Sturms, describes it as an instrument that a scientific optician would be ashamed to make: and Helmholtz was no atheist.[1] Again the immutability and separate creation of species, which Cuvier and other distinguished naturalists long stoutly maintained, are doctrines now no longer defensible. And without them the unique position assigned to man in the scale of organic life — for the sake of which, it is not too much to say, Cuvier and his allies held out so desperately — can be claimed for man no more. "The grounds upon which this conclusion rests," says Darwin, the conclusion, *i.e.*, that man is descended from some less highly organised form, "will never be shaken, for the close similarity between man and the lower animals in embryonic development as well as in innumerable points of structure and constitution, both of high and of the most trifling importance, — the rudiments which he retains, and the abnormal reversions to which he is occasionally liable, — are facts which cannot be disputed."[2] And certainly the unanimity with which this conclusion is now accepted by biologists of every school seems to justify Darwin's confidence a quarter of a century ago. And not merely man's erect gait and noble bearing, but his speech, his reason, and his conscience too, are now held to have been originated in the course of a vast process of evolution, instead of being ascribed, as formerly, to the inspiration and illumination of the Divine Spirit directly intervening.

[1] *Popular Lectures*, 1893, vol. i, p. 194.

[2] *The Descent of Man*, 1871, vol. ii, p. 385.

But vast as the circuit of modern science is, it is still of course limited. On no side does it begin at the beginning, or reach to the end. In every direction it is possible to leave its outposts behind, and to reach the open country where poets, philosophers, and prophets may expatiate freely. However, we are not for the present concerned with this extra-scientific region — the metempirical as it has been called: what we have to notice is rather the existence of serious gaps *within* the bounds of science itself. But over these vacant plots, these instances of *rus in urbe*, science still advances claims, endeavouring to occupy them by more or less temporary erections, otherwise called working hypotheses. Concerning such gaps more must be said presently. Meanwhile, it may suffice to refer to one or two in passing, as our immediate concern is only to understand the claim of science to include them within its domain, though it can occupy them only provisionally.

There is first the great gap between the inorganic and the organic world. Even if astronomical physics will carry us smoothly from chaotic nebulosity to the order and stability of a solar system, and if again "it does not seem incredible that from . . . low and intermediate forms, both animals and plants may have been developed";[1] still what of the transition from the lifeless to the living? There is no physical theory of the origin of life. Nothing can better shew the straits to which science is put for one than the reception accorded to Lord Kelvin's forlorn suggestion that possibly life was brought to this planet by a stray meteorite!

[1] *Origin of Species*, sixth edition, p. 425.

But, on the other hand, taking living things as there, science finds nothing in their composition or in their processes physically inexplicable. The old theory of a special vital force, according to which physiological processes were at the most only analogous to — not identical with — physical processes, has for the most part been abandoned as superfluous. Step by step within the last fifty years the identity of the two processes has been so far established, that an eminent physiologist does not hesitate to say "that for the future, the word 'vital' as distinctive of physiological processes might be abandoned altogether."[1] It is allowed that life has never been found to arise save through the mediation of already existing life — in spite of many a long and arduous search. Yet, on the ground that vital phenomena furnish no exceptions to purely physical laws, it is assumed that life at its origin — if it ever did originate — formed no break in the continuity of evolution. This instance may perhaps be taken as a type of the scientific treatment of existing lacunæ in our empirical knowledge. Wherever there are reasons for maintaining that a natural explanation is *possible*, though none is, in fact, forthcoming, there actual discontinuity and the supernatural are held to be excluded.

But this principle is put to a far severer trial when we pass from the physical aspect of life to the psychical. The coarse and shallow materialism that disposed of this difficulty with an epigram, "The brain secretes thought as the liver secretes bile," only served to set the

[1] Professor Burdon Sanderson, *Opening Address* to the Biological Section, British Association, 1889. *Nature*, vol. xl, p. 522.

problem in a clearer light. For it is just the hopelessness of the attempt to resolve thought into a physiological function that is the difficulty. And accordingly, within twenty years after Karl Vogt's flippant utterance, we find the physiologist, Du Bois-Reymond, answering this 'riddle,' not merely with an *Ignoramus*, but with an *Ignorabimus*. Indeed, nowadays there is nothing that science resents more indignantly than the imputation of materialism. For, after all, materialism is a philosophical dogma, as much as idealism. It professes to start from the beginning, which science can never do; and, when it is true to itself, never attempts to do. Modern science is content to ascertain coexistences and successions between facts of mind and facts of body. The relations so determined constitute the newest of the sciences, psychophysiology or psychophysics. From this science we learn that there exist manifold correspondences of the most intimate and exact kind between states and changes of consciousness on the one hand, and states and changes of brain on the other. As respects complexity, intensity, and time-order the concomitance is apparently complete. Mind and brain advance and decline *pari passu;* the stimulants and narcotics that enliven or depress the action of the one tell in like manner upon the other. Local lesions that suspend or destroy, more or less completely, the functions of the centres of sight and speech, for instance, involve an equivalent loss, temporary or permanent, of words and ideas. Yet, notwithstanding this close and undeviating parallelism between conscious states and neural states, it is admitted, as I have already said, that the two

cannot be identified. It is possible, no doubt, to regard a brain change as a case of matter and motion, but the attempt to conceive a change of mind in this wise is allowed to be ridiculous.

But though these two sets of facts cannot be identified, as the physical and the physiological may be, yet, since they vary concomitantly, may not causal connexion at all events be safely affirmed of them? Yes, it is said, if that means merely that the connexion is not casual. When, however, the attempt is made to determine an event in either as the cause or the effect of the concomitant event in the other, the difficulties seem insuperable. There is not merely the difficulty that the two seem strictly coincident in time, so that all question of sequence is excluded—although this difficulty is one on which stress has been laid. But, in addition, the series of neural events—being physical—is already, so to say, closed and complete within itself, each neural state is held to be wholly the effect of the neural state immediately preceding it, and the entire cause of that directly following. In other words, the master generalisation of the physical world, that of the conservation of energy would be violated by the assumption that energy could appear or disappear in one form without at once disappearing or reappearing to a precisely equivalent amount in another. Brain changes could not then be transformed into sensations, or volitions be transformed into brain changes, without a breach of physical continuity; and of such a breach there is supposed to be no evidence.

The position, then, of science in the present day as regards what I have called the gap between the psy-

chical and the physical is briefly this: If the mechanical theory of the material world including the modern principle of energy is not to be impugned, then there is no natural explanation of the parallelism that exists between processes in brain and processes in consciousness; the gap is one across which no causal links can be traced. This amount of dualism science seems content to admit rather than forego the strict continuity and necessary concatenation of the physical world. But it is not regarded as the sort of discontinuity that sets empirical generalisation at defiance or points directly to supernatural interference. True, the gulf is such that the utmost advance on the physical side would not, of itself, help on psychology in the least, nay would not even suggest to the physicist, pure and simple, the existence of the psychical side at all. True, again, the gap is such that psychology, keeping strictly to its own domain, gives no hint of the existence of that physical mechanism of brain, nerve, and muscle, by which it is so intimately shadowed, or — as many very arbitrarily prefer to say — which it so intimately shadows. But this very concomitance is itself a uniformity of nature, a uniformity of coexistence, and no limit can be assigned to the extent to which psychophysics may succeed in determining its details. Inasmuch as supernatural intervention is not invoked by physiology or psychology severally, psychophysics can obviously dispense with it in merely correlating the two. As a result of our brief survey, then, we find that "the ideas and the will of the one necessarily existing Being," to which Newton referred, do not figure even as a working hypothesis anywhere

within the range of that systematic exposition of "the whole diversity of natural things," that calls itself modern science.

This summary of existing knowledge about whatever comes to be is confessedly meagre in the extreme. To many it will suggest objections and to some it may seem obscure. I shall myself have objections in plenty to make and to meet, as best I may, later on; as to the obscurity, this I fear could only be remedied by an elaboration of detail which would call for more time than we can spare. Moreover, this defect is made good already in sundry well-known essays and addresses by men like Huxley, Tyndall, Clifford, Helmholtz, Du Bois-Reymond, and others. Besides, it is precisely the broadest and most general characteristics, not the details, of the current science of nature, that I wish to emphasise. Let me then, before attempting to advance further, ask your patience while I try to restate them in another way.

We note first of all the old dualism of Matter and Mind, or rather — since a duality of substances is nowadays neither asserted nor denied — the dualism of so-called material and mental phenomena. As to material phenomena — that is to say wherever there is matter in motion, whether planets revolving round a sun or molecules vibrating in a living frame, over all these — certain mechanical laws are held to be supreme; that a single atom should deviate from its predetermined course were as much a miracle as if Jupiter should break away from its orbit and set the whole solar system in commotion. Matter and energy are the two fundamental conceptions

here. The amount of both is constant, and even independent, in so far as matter cannot be raised to the dignity of energy nor energy degraded to the inertness of matter. But the energy of any given body or material system may vary indefinitely, provided only every increase or decrease shall entail always an equivalent decrease or increase by transfer to or from other bodies or systems. Thus the continuity and solidarity of the material world is complete; but there is no limit to the diversities which it may assume, provided its physical unity and concatenation are strictly conserved.

When we turn to what are called mental phenomena we find nothing answering to this quantitative constancy, inviolable continuity, and strict reciprocity. Minds are not a single conservative system as matter and energy are. What one mind gains in ideas, feeling, strength of will, another does not necessarily lose. We have here a number of separate individuals, not a single continuum. But on the other hand we know nothing of minds without a living body and without external environment. Between each living body and this environment there is a continuous exchange of material — the metabolism of physiologists — accompanied by a constant give and take of energy. While the organism gains in this exchange, it thrives and developes, goes up in the world; as it loses, it begins to decline and perish, to go down in the world. But, as all organisms collectively, together with their environments, constitute the constant and continuous physical system, indefinite increase and advance all round are impossible. Sooner or later what we describe as struggle must ensue, leading to 'the survival of the

fittest,' as its result. But conscious life is found to rise and fall with organic efficiency and position, so that (completely isolated and distinct as the consciousness of A is from that of B), all minds are indirectly connected; each is yoked to its own body and through this body to the one material world. Of other connexions and relations that minds may have wholly independent of this physical connexion, we have so far no experience; all intercourse, all tradition, is mediated through the one physical world.

So then the concomitance of mind with body is invariable; concomitance of body with mind on the other hand is not certainly more than occasional, even exceptional. Moreover, keeping strictly to the psychological standpoint, we can never get beyond qualitative description and rough classification, natural history in a word, not natural science. And this would be true even though, in *individual* cases, quantitative determinations were possible, which however they are not. For there are certainly no *common* psychological units of intensity or duration; no mind-stuff fixed in amount; no psychical energy that must be conserved. Thus, on the physical side we have a single system, unvarying law, quantitative exactness, complete concatenation of events — in a word, one vastly complex, but rigidly adjusted, mechanism. But on the psychical side we have as many worlds as there are minds, connected indeed, yet independent to an indefinite extent; a series of partial and more or less disparate *aperçus* or outlooks; each for itself a centre of experience, but all without any exact orientation in common. Psychology, pure and simple, has

always been individualistic and accepted, tacitly at least, the *Homo Mensura* doctrine. Again, on the physical side the elements with which we deal are held to be indestructible and unalterable, the same always and everywhere. Whereas minds, so far as we know them, are the subjects of continual flux while they last; and seem to arise and melt away like streaks of morning cloud on the stable firmament of blue. But though all these unique and transient centres of thought and feeling are psychologically as isolated and individual as mountain summits, oases in a desert, or stars in space, yet they are indirectly related through physical organisms, which are integral parts of the one great mechanism. To set out, then, from this one permanent material scheme and to trace its working through the fleeting multitude of vital sparks, as one follows the stem of a tree up into its branches with their changing leaves and fruit — that is a sure, synthetic, and direct method. But to attempt, setting out from these sporadic and shifting complexities, to reach an abiding and fundamental unity, is as precarious as analytic and inverse methods always are; and possibly it is altogether hopeless. In brief, then, we are to conclude that, in proportion as psychological facts are physiologically interpretable, and in proportion agáin as their physiological concomitants are physically explicable, in that same proportion will every fact of mind have a definite and assignable place as an epiphenomenon or concomitant of a definite and assignable physical fact, and our empirical knowledge approximate towards a rounded and complete whole.

No doubt such consummation of natural science is

indefinitely far off. But it is an ideal. Let me cite a single and very eminent witness. "Any one who is acquainted with the history of science," says Professor Huxley, "will admit, that its progress has, in all ages, meant, and now more than ever means, the extension of the province of what we call matter and causation, and the concomitant gradual banishment from all regions of human thought of what we call spirit and spontaneity. . . . And as surely as every future grows out of past and present, so will the physiology of the future gradually extend the realm of matter and law until it is coextensive with knowledge, with feeling, and with action. The consciousness of this great truth," Mr. Huxley believes, "weighs like a nightmare upon many of the best minds of these days. They watch what they conceive to be the progress of materialism in such fear and powerless anger as a savage feels, when, during an eclipse, the great shadow creeps over the face of the sun. The advancing tide of matter threatens to drown their souls; the tightening grasp of law impedes their freedom."[1]

The alarm and perplexity are, in Professor's Huxley's opinion, alike needless; the "strong and subtle intellect" of David Hume, if only we would ponder his words and accept his "most wise advice" would, he thinks, soon allay our fears and give us heart again. The advice is well-known, but as it will fitly introduce a new trait in the modern scientific attitude, the main features of which it is our present business to characterise, I will ask leave to re-quote it. It was in the

[1] *Collected Essays*, Eversley edition, vol. i, pp. 159 ff.

Inquiry concerning the Human Understanding that Hume wrote: "If we take in hand any volume of divinity, or school metaphysics, for instance, let us ask, Does it contain any abstract reasoning concerning quantity or number? No. Does it contain any experimental reasoning concerning matter of fact and existence? No. Commit it then to the flames; for it can contain nothing but sophistry and illusion." How this advice is to dispel perplexity at "the advancing tide of matter and the tightening grasp of law," and how it is to reassure those who are alarmed lest man's moral nature should be debased by the increase of his knowledge, are perhaps not straightway obvious! Well, the comfort consists simply in saying: *After all the knowledge is very superficial and must always remain so.* As Professor Huxley puts it: "What, after all, do we know of this terrible 'matter' except as a name for the unknown and hypothetical cause of states of our own consciousness? And what do we know of that 'spirit' over whose threatened extinction by matter a great lamentation is arising, . . . except that it is also a name for an unknown and hypothetical cause, or condition, of states of consciousness? And what is the dire necessity and 'iron' law under which men groan? Truly, most gratuitously invented bugbears. . . . Fact I know, and Law I know; but what is this necessity save an empty shadow of my own mind's throwing — something illegitimately thrust into the perfectly legitimate conception of law?" "The fundamental doctrines of materialism," continues Professor Huxley, "like those of spiritualism and most other 'isms' lie outside the limits of philo-

sophical inquiry; and David Hume's great service to humanity is his irrefragable demonstration of what these limits are."

In this deliverance of Professor Huxley we have a fragment of that particular 'ism' for which he is proud to be sponsor and which he has christened Agnosticism. It is in fact that doctrine that has led modern science, as I have already remarked, to separate itself from the pronounced materialism and atheism so common in scientific circles half a century or so ago. But it is only in its bearing on the ideal of knowledge just described that agnosticism concerns us at present. Professor Huxley — in this point following the lead of Mr. Herbert Spencer — concludes the consolatory reflections he derives from Hume and returns to his first position in this wise: "It is in itself of little moment whether we express the phenomena of matter in terms of spirit, or the phenomena of spirit in terms of matter — each statement has a certain relative truth. But with a view to the progress of science, the materialistic terminology is in every way to be preferred. For it connects thought with the other phenomena of the universe, . . . whereas, the alternative, or spiritualistic, terminology is utterly barren, and leads to nothing but obscurity and confusion of ideas. Thus there can be little doubt, that the further science advances, the more extensively and consistently will all the phenomena of Nature be represented by materialistic formulæ and symbols."

This 'nightmare' theory of knowledge, as regards its exclusion of everything supernatural or spiritual, thus closely resembles the doctrines which in the seventeenth

century they called Naturalism. And the name has recently been revived. But it is important to bear in mind the difference already noted. Naturalism in the old time tended dogmatically to deny the existence of things divine or spiritual, and dogmatically to assert that matter was the one absolute reality. But Naturalism and Agnosticism now go together; they are the complementary halves of the dominant philosophy of our scientific teachers. So far as knowledge extends all is law, and law ultimately and most clearly to be formulated in terms of matter and motion. Knowledge, it is now said, can never transcend the phenomenal; concerning 'unknown and hypothetical' existences beyond and beneath the phenomenal, whether called Matter or Mind or God, science will not dogmatise either by affirming or denying. This problematic admission of undiscovered country beyond the polity of science has tended powerfully to promote the consolidation of that polity itself. Release from the obligation to include ultimate questions has made it easier, alike on the score of sentiment and of method, to deal in a thoroughly regimental fashion with such definite coexistences, successions, resemblances, and differences as fall within the range of actual experience. The eternities safely left aside, the relativities become at once amenable to system. All this is apparent in the passages just quoted from Professor Huxley.

But I pass now to a new point. Agnosticism, we have just seen, has reacted upon naturalism, inducing in it a more uncompromising application of scientific method to all the phenomena of experience. And it will be found that naturalism in its turn has reacted upon agnosticism,

inducing in that a more pronounced scepticism, or even the renunciation of higher knowledge as a duty, in place of the bare confession of ignorance as a fact. The contrast between the certainty of science, with its powers of prediction and measurement, and the uncertainty of philosophic speculation, forever changing but never seeming to advance, has been one source of this agnostic despondency. The long record of attempts that can only appear as failures, the many highly gifted minds, as it seems, uselessly sacrificed in the forlorn enterprise of seeking beneath the veil of things for the very heart of truth — this, when contrasted with the steady growth of scientific knowledge, might well, as Kant puts it, "bring philosophy, once the queen of all the sciences, into contempt, and leave her, like Hecuba forsaken and rejected, bewailing: *modo maxima rerum, tot generis natisque potens — nunc trahor, exul, inops*."[1] But since Kant's day the position of philosophy has become still more desperate. That agnosticism — for such we might call it — by which he himself supplanted the bold but baseless metaphysics of his rationalistic predecessors, is now in turn scouted as transcendental and surreptitious; is charged, that is, with borrowing from experience the very forms on whose strictly *a priori* character it would rest the possibility of experience. By the advance of what has been called metageometry, still more by the advance of experimental and comparative psychology, and by the wide reach of the conception of evolution, science has encroached upon what Kant regarded as the province of the *a priori*. He allowed that all our knowledge begins

[1] *Critique of Pure Reason*, first edition, Pref., p. 3.

with experience and is confined to experience. He allowed that if the several particulars of that experience had been different, as they conceivably might have been, our *a posteriori* generalisations would have varied in like manner. But a spontaneous generation of knowledge from sense particulars without the aid of *a priori* formative processes, was to him as inconceivable as the spontaneous generation of a living object from lifeless matter without the aid of a vital principle. But now that the physical origin of life is regarded as not merely credible but certain, *a priori* forms of knowledge are out of fashion. Kant's position, in a word, is held to be outflanked. There can be no science without self-consciousness; but then this very self-consciousness, it is said, has been evolved by natural processes. Nature herself has polished, and apparently is still polishing, the mirror in which she sees herself reflected. Kant's dialectic against dogmatic metaphysics is thankfully accepted; but his theory of knowledge is held to be superseded by a better psychology and a better anthropology. All this, of course, really amounts to saying that there can be no theory of knowledge at all as distinct from an account of the natural processes by which, as a fact in time, knowledge has come to be. The *solvitur ambulando* procedure is at once the most effective and the most summary method of dealing with this position, and we shall have to try our best at it later on.

Meantime one or two remarks on this unreflective, uncritical, character of modern science may serve to complete this preliminary sketch of its attitude towards the problem of theism. We have seen that, on the one

hand, it allows no place for Natural Theology or such knowledge of God as the constitution of nature may furnish; and that, on the other, it denies the title of Knowledge to Rational Theology, or such knowledge of God as philosophy may claim to disclose. We have seen further that these negations have two main grounds: first, the Laplacean *dictum*, which Naturalism adopts, that science has no need of the theistic hypothesis; and secondly, the Humean, or ultra-agnostic, *dictum*, that what is neither abstract reasoning concerning quantity or number, nor yet experimental reasoning concerning matter of fact or existence, can only be sophistry or illusion. Disregarding Hume's somewhat rhetorical phraseology, these two statements amount to saying, first, that there is no knowledge save scientific knowledge, or knowledge of phenomena and of their relations, and secondly, that this knowledge is non-theistic. It is worth our while to note that in a sense both these propositions are true, and *that* is the sense in which science in its every-day work is concerned with them. But again there is a sense in which, taken together, these propositions are not true, but this is a sense that will only present itself to the critic of knowledge reflecting upon knowledge as a whole. Thus it is true that science has no need, and indeed, can make no use, in any particular instance, of the theistic hypothesis. That hypothesis is specially applicable to nothing just because it claims to be equally applicable to everything. Recourse to it as an explanation of any specific problem would involve just that discontinuity which it is the cardinal rule of scientific

method to avoid. But, because reference to the Deity will not serve for a physical explanation in physics or a chemical explanation in chemistry, it does not therefore follow that the sum total of scientific knowledge is equally intelligible whether we accept the theistic hypothesis or not. Again, it is true that every item of scientific knowledge is concerned with some definite relation of phenomena or of ideas and with nothing else. But, for all that, the systematic organization of such items may quite well yield further knowledge which transcends the special relations of definite phenomena. In fact, so surely as science collectively is more than a mere aggregate of items or 'knowledges,' as Bacon would have said, so surely will the whole be more, and yield more, than the mere sum of its parts.

And the strictly philosophical term 'phenomenon,' to which science has taken so kindly, is in itself an explicit avowal of relation to something beyond that is not phenomenal. Mr. Herbert Spencer who, more perhaps than any other writer, is hailed by our men of science as the best exponent of their first principles, is careful to insist upon the existence of this relation of the phenomenal to the extra-phenomenal, noumenal, or ontal. His synthetic philosophy opens with an exposition of this "real Non-relative or Absolute," as he calls it, without which the relative itself becomes contradictory. And when Mr. Spencer speaks of this Absolute as the Unknowable, it is plain that he is using the term 'unknowable' in a very restricted sense. I say this, not merely because he devotes several chapters to its elucidation, for these might have been

purely negative; but also because it is an essential part of Mr. Spencer's doctrine to maintain that "our consciousness of the Absolute, indefinite though it is, is positive and not negative";[1] that "the Noumenon everywhere named as the antithesis of the Phenomenon, is throughout necessarily thought of as an actuality";[2] that, "though the Absolute cannot in any manner or degree be known, *in the strict sense of knowing*, yet we find that its positive existence is a necessary datum of consciousness; that so long as consciousness continues, we cannot, for an instant, rid it of this datum; and that thus the belief which this datum constitutes, has a higher warrant than any other whatever."[3] In short the Absolute or Noumenal according to Mr. Spencer, though not known in the strict sense, that is as the phenomenal or relative is known, is so far from being a pure blank or nonentity for knowledge that this phenomenal — which *is* said to be known in the strict sense—is inconceivable without it. It is worth noting, by the way, that 'this actuality behind appearances,' without which appearances are unthinkable, is by Mr. Spencer identified with that 'ultimate verity' on which religion ever insists. His general survey of knowledge then has led this pioneer of modern thought, as he is accounted to be, to reject both the Humean dictum that there is no knowledge save knowledge of phenomena and of their relations, as well as the Laplacean dictum that this knowledge is non-theistic.

But it might be maintained that the several relations

[1] *First Principles*, Stereotyped Edition, § 26, p. 92.

[2] *o.c.*, p. 88. [3] *o.c.*, § 27, omitted in the Revised Edition, p. 98.

among phenomena may suffice in their totality to constitute an Absolute. Possibly it may be so; this much remains for the present an open question. But even so, it would still be true that any knowledge of this Absolute would not be phenomenal knowledge. Science, which is chary of all terms with a definitely theistic implication, talks freely of the Universe and of Nature; but I am at a loss to think of any single *scientific* statement that has been, or can be, made concerning either the one or the other. By scientific statement I mean one that having a real import is either self-evident or directly proved from experience.[1]

There is still another possibility, some seem to think, which, however, has not yet been realised, and which indeed, it seems to me, never can be realised. It might conceivably have happened, they say, that our finite knowledge of phenomena proved to be a complete and rounded whole as far as it went, a sort of microcosm within the macrocosm; a model of the whole universe on a scale appropriate to our human faculties, rather than a fragment with hopelessly 'ragged edges.' And despite the many obstinate questionings that show the contrary, it is far from unusual to find scientific men talking as if this preferable ideal, as some perhaps think it, was the sober fact. Thus Mr. Spencer, though controverting all such views, nevertheless describes "science as a gradually increasing sphere," such that "every addition to its surface does but bring it into wider contact with surrounding nescience." True, this with

[1] Kant's discussion of the cosmological antinomies is instructive here in its method even more than in its results.

Mr. Spencer is only a metaphor, whereas for Comte it was a doctrine; but as metaphor or as doctrine it is widely current and most misleading. Our knowledge is not only bounded by an ocean of ignorance, but intersected and cut up as it were by straits and seas of ignorance; the *orbis scientiarum*, in fact, if we could only map out ignorance as we map out knowledge, would be little better than an archipelago, and would show much more sea than land.

Of course the rejoinder will be made, "We admit the intervening streaks and shallows; but here our ignorance, like our knowledge, is only relative, whereas, of the illimitable ocean beyond, our ignorance is absolute and profound. By the help of postulates and generalisations which our perceptive experience confirms, and by the help of hypotheses congruent with our present experiences and verifiable by experiences yet to come, we have completed the circle of the sciences and built up a *Systema Naturæ*." I have endeavoured to describe this system of natural knowledge, as it is commonly conceived by those whose genius and enterprise we have to thank for it. The said fundamental postulates and unrestricted generalisations, the various assumptions consciously or unconsciously made, the hypothetical abstractions by which this unity is secured — to all these we must give our best attention later. For the moment I am concerned only with this one conceit: that the several sciences by their mutual attraction, if I might so say, together form a single whole, *totus teres atque rotundus*, floating in "an interminable air" of pure nescience. But unless we are prepared to repudiate logic

altogether, this sharp severance of known and unknown, knowable and unknowable, must be abandoned, so radical are the contradictions that beset it. Where nescience is absolute, nothing can be said; neither that there is more to know nor that there is not. But if science were verily in itself complete, this could only mean that there was no more to know; and then there could be and would be no talk of an environing nescience.

Again, if nescience is real,—is such, I mean, that we are conscious of it,—we must at least know that there is more to know. But how can we know this? To say that we know it because of the incompleteness of the phenomenal relations actually ascertained, may be true enough; but of course such an admission gives up at once the *solid* unity of science as it is and the *utter* vacuity of the opposed nescience. We must suppose then that phenomenal knowledge is regarded as *ideally complete*—the fragments sufficing at least to suggest an outline of the whole, helped out by ultimate generalisations such as the conservation of matter and energy, the principle of evolution, and the like. And if it is still held that there is an endless and impalpable envelope of nescience beyond this ideally perfect sphere of positive knowledge, this can only be because the phenomenal implicates the noumenal; the known and knowable, as Mr. Spencer and others teach, being necessarily related to the 'unknowable,' which means, we must remember, the not strictly knowable. But this doctrine too is fatal to any thoroughgoing dualism of science and nescience; on the contrary, it amounts to a dualism of knowledge. As Mr. Spencer himself says:

"The progress of intelligence has throughout been dual. Though it has not seemed so to those who made it, every step in advance has been a step towards both the natural and the supernatural. The better interpretation of each phenomenon has been, on the one hand, the rejection of a cause that was relatively conceivable in its nature but unknown in the order of its actions, and, on the other hand, the adoption of a cause that was known in the order of its actions but relatively inconceivable in its nature. . . . And so there arise two antithetical states of mind, answering to the opposite sides of that existence about which we think. While our consciousness of Nature under the one aspect constitutes Science, our consciousness of it under the other aspect constitutes Religion."[1]

Finally, if on the other hand, it be held that phenomenal knowledge, when ideally complete, will be clear of these noumenal and supernatural implications, then this position again is incompatible with a dualism between science and nescience. For if the sphere of science were so complete as to be clear of all extra-scientific implications, then, as I have already said, there would be no nescience. If, however, there must be nescience so long as science is finite and relative, then *so long* the metaphysical ideas of the Absolute and the Infinite will transcend the limits of actual science, and yet will have a place within the sphere of science ideally complete. In other words, ideally complete science will become philosophy. This conceit or doctrine of an absolute boundary between science and nescience and the en-

[1] *First Principles*, § 30, stereo. ed., p. 106 *fin.*; rev. ed., p. 91.

deavour to identify with it a like sharp separation between empirical knowledge and philosophic speculation may then, we conclude, be both dismissed as "sophistical and illusory." Nevertheless, as I have said, these notions are widely current in one shape or other, save among the few in these days, who have even a passman's acquaintance with the rudiments of epistemology. One of the most plausible and not least prevalent forms of this doctrine is embodied in the shallow Comtian 'Law of Development,' according to which there are three stages in human thought, the theological, the metaphysical, and the positive; the metaphysical superseding the theological and being in turn superseded by the positive or scientific. A glance at the past history of knowledge would shew at once the facts that make these views so specious and yet prove them to be false.

And now to resume what has been said, and to conclude: I have tried to present an outline sketch of that polity of many mansions, which we may call the Kingdom of the Sciences, and the mental atmosphere in which its citizens live. As the constant inhabitants of large towns, though familiar with shops supplying bread and beef, know nothing of the herds in the meadows or the waving fields of wheat, so the mere *savant* is familiar with 'phenomena and their laws' and with the methods by which they are severally measured and ascertained, but rarely or never thinks of all that 'phenomena' and 'law' and 'method' imply. As a knowledge of what is thus beyond his purview cannot be attained by experiment or calculation, it should surprise us as little to find him associate it with nescience as it sur-

prises us to find the urchins in a slum confusing with the tales of fairy-land what we may try to tell them of the actual facts of country life.

Indeed the resemblance in the two cases is closer than at first it seems. For it is very common for those who decline to recognise Natural or Rational Theology to speak with fervour of what I think we might fairly call Æsthetic Theology. Tyndall, for example, in his once famous Belfast Address to the British Association, spoke thus to the assembled representatives of science: "You who have escaped from these religions into the high-and-dry light of the intellect may deride them; but in so doing you deride accidents of form merely, and fail to touch the immovable basis of the religious sentiment in the nature of man. To yield this sentiment reasonable satisfaction is the problem of problems at the present hour."[1] It seems clear that in Tyndall's opinion this reasonable satisfaction could not need, at any rate, must not have, an intellectual basis either 'high-and-dry,' or otherwise. For he proceeds to describe this religious sentiment as "a force, mischievous, if permitted to intrude on the region of *knowledge*, over which it holds no command, but capable of being guided to noble issues in the region of *emotion*, which is its proper and elevated sphere." Yet a page or two further on Tyndall brings his address to a close with these words: "The inexorable advance of man's understanding in the path of knowledge, and those unquenchable claims of his moral and emotional nature which the understanding can never satisfy, are here equally set forth. The world

[1] Reprint of Address, 1874, p. 60.

embraces not only a Newton, but a Shakespeare—not only a Boyle, but a Raphael—not only a Kant, but a Beethoven—not only a Darwin, but a Carlyle. Not in each of these, but in all, is human nature whole. They are not opposed, but supplementary; not mutually exclusive, but reconcilable. And if, unsatisfied with them all, the human mind, with the yearning of a pilgrim for his distant home, will still turn to the Mystery from which it has emerged, seeking so to fashion it as to give unity to thought and faith; so long as this is done, not only without intolerance or bigotry of any kind, but with the enlightened recognition that ultimate fixity of conception is here unattainable, and that each succeeding age must be held free to fashion the Mystery in accordance with its own needs—then, casting aside all the restrictions of Materialism, I would affirm this to be a field for the noblest exercise of what, in contrast with the *knowing* faculties, may be called the *creative* faculties of man."

I am really at a loss to know whether this is to be taken for climax or anti-climax, pathos or bathos. But of one thing I am sure: tried by the "high-and-dry light of the intellect" this specimen of Professor Tyndall's "eloquence and scientific fire," as the *Saturday Review* called it, will not help us to solve the 'problem of problems.'

Surely the late professor must have thought lightly of his own teaching, to be ready under the influence of an emotional yearning to cast aside the doctrine to which an "intellectual necessity" (p. 55) had led him, the doctrine by which he discerned in matter "the promise and potency of all terrestrial life"; nay, fur-

ther, to be ready to refashion the Mystery from which the human mind has emerged so as "to give unity to thought and faith." If religious sentiment must not be permitted to intrude on the region of knowledge, how is the refashioning in the interests of this unity to begin? And if nothing short of *creative* faculties can satisfy this sentiment, what about 'the danger' and 'the mischief' to the work of the *knowing* faculties when such sentiment does intrude?

Professor Tyndall does not tell us where he went for his psychology. But Mr. Spencer, to whom he frequently refers, would have taught him that no sentiments are entirely without a cognitive basis, the religious perhaps least of all. This cognitive element in religious sentiment is of necessity amenable to intellectual challenge, just because it is itself of necessity intellectual. No doubt, "ultimate fixity of conception is here unattainable"; but when Professor Tyndall tells us this, has he forgotten that on the very same page he has also declared "it certain that [scientific] views will undergo modification"? In fact, just as religious sentiment implies knowledge, so too do the high-and-dry constructions of the intellect involve "creative faculties"; finality will be impossible and reconstruction a necessity in both regions so long as we only "know in part." But why do I talk of the regions of knowledge? The semblance of two regions, one pure fact, the other pure fancy, one all science, the other all nescience, is just the error that I have been trying to expose and to which this utterly unscientific notion of an emotional theology is due.

PART I

THE MECHANICAL THEORY

LECTURE II

ABSTRACT DYNAMICS

The demurrer of modern scientific thought, though illegitimately, yet practically, forecloses theistic inquiries. A discussion of its fundamental positions therefore called for in the interest of such inquiries.

Natural knowledge to be examined (i) formally *as knowledge*, (ii) *as a body of* real *principles. Beginning with the latter, we have* (*a*) *the mechanical theory of Nature*, (*b*) *the theory of Evolution, and* (*c*) *the psychophysical theory of Body and Mind.*

A. The Mechanical Theory: — *The Laplacean calculator; different views of him; he excludes the teleological. Abstract dynamics, a strictly mathematical science, the basis of this theory, which thus divests itself of the real categories of Substance and Cause, and substitutes for them the quantitative terms 'Mass' and 'Force'* (*or Mass-acceleration*). *But if this be so, Laplace's calculator never attains to real knowledge.*

Any attempt in these days to discuss the problem of theism is, we have seen, liable to demurrers more or less emphatic from what we may fairly call the spirit of the age. Naturalism, speaking in the name of science, declares the problem superfluous, and agnosticism, professing to represent reason, declares it to be insoluble. This attitude we have traced to that positivist conception of knowledge which the rapid advances of science and the repeated failures of philosophy have jointly encouraged. Referring to this conception G. H. Lewes remarks:

"A new era has dawned. For the first time in history an explanation of the world, society, and man is presented which is thoroughly homogeneous and at the same time thoroughly in accordance with accurate knowledge; having the reach of an all-embracing system, it condenses human knowledge into a Doctrine, and coördinates all the methods by which that knowledge has been reached, and will in future be extended. . . . Its basis is science—the positive knowledge we have attained, and may attain, of all phenomena whatever. Its superstructure is the hierarchy of the sciences, *i.e.*, that distribution and coördination of general truths which transforms the scattered and independent sciences into an organic whole, wherein each part depends on all that precede and determines all that succeed."[1] In the last lecture we made a cursory examination of this *soi-disant* organic whole of phenomenal knowledge. Even that brief survey would justify us in saying: First, that it is not in itself a homogeneous and organic whole; for the dualism of matter and mind, at any rate, runs through it, and is only evaded by desperate means. Materialism itself is repudiated, but the materialistic terminology is retained as primary and fundamental. Secondly, that it is not a whole of accurate, positive, knowledge; for it confessedly involves postulates and methods, which it is the business of no one of 'the scattered and independent sciences' to scrutinise, and which they all alike, therefore, accept in a naïve and uncritical fashion. Finally, that it is not an all-embracing system. Hamilton has supplied it with a Virgilian motto: *Rerumque* ignarus, *imagine* gaudet. The 'accu-

[1] *History of Philosophy*, 3d edition, vol. ii, p. 590.

rate and strict' knowledge of appearances implicates an indefinite but still positive consciousness of an ultimate Reality; for, says Mr. Spencer, "it is rigorously impossible to conceive that our knowledge is a knowledge of Appearances only without at the same time conceiving a Reality of which they are appearances, for appearance without reality is unthinkable."[1]

But since the theistic problem deals primarily with spirit, not with matter, since further it involves those fundamental principles of knowledge which science is not concerned to discuss, and since finally it belongs to that extra-scientific or supernatural region of 'nescience' which science allows to be, but to lie forever beyond its pale, we might, if so disposed, reasonably contend that the demurrer both of Naturalism and of Agnosticism is altogether *ultra vires;* we might politely request science to mind its own business and proceed at once to our own. In so doing, too, we could safely count on the approval and good-will of many eminent representatives of science in every department. For, after all, agnosticism and naturalism are not science, but, so to say, a philosophy of knowing and being which seems specially plausible to, and hence is widely prevalent among, scientific men. But just for this reason it would ill become us to treat them with cavalier disdain. If Gifford Lectures were less numerous, I might not perhaps be justified in devoting a whole course to these initial objections; but as every university in Scotland has always its Gifford Lecturer, I venture to think such restriction is not only allowable but desirable.

[1] *First Principles,* stereo. ed., § 26, p. 88.

Our knowledge of nature, as unified and systematised according to the naturalistic scheme, may be considered from two sides. We may examine it *formally*, as knowledge, in respect, that is to say, of its postulates, categories, and methods. Or, taking these for granted, as science itself does, we may examine those of its *real* principles to which its supposed unity and completeness are ascribed. Some odd instances of confusion could be cited due to a mingling of these two points of view — a favourite practice with those who, like Huxley and Tyndall, are at once fervent naturalists and pronounced agnostics. We may know where we are when matter is spoken of throughout as an objective fact, or throughout as a mental symbol, but it is bewildering to find it posing in both characters at once. To begin with, let us then, postpone any attempt to get behind the plain deliverances of science by epistemological reflexions; let us give our attention first to its real principles.

There are three fundamental theories which — as we have already noted — are held to be primarily concerned in the unity of nature: *the mechanical theory*, this comes first and 'determines all that succeed'; *the theory of evolution*, which essays in terms homogeneous with this to 'formulate' the development of the world, society, and man; last, *the theory of psychophysical parallelism*, dealing with the relation of body and mind. To the first of these we may now pass.

There is a well-known passage at the beginning of Laplace's essay on Probability, which may serve as a basis for the remarks I have to offer on the MECHANICAL THEORY OF NATURE. Having enounced as an axiom —

known, he says, as *the principle of sufficient reason*, that "a thing cannot begin to be without a cause to produce it," and having summarily disposed of the notion of free-will as an easily explained illusion, Laplace proceeds: "We ought then to regard the present state of the universe as the effect of its antecedent state and as the cause of the state that is to follow. An intelligence, who for a given instant * should be acquainted with all the forces by which nature is animated and with the several positions of the beings composing it, if further his intellect were vast enough to submit these data to analysis, would include in one and the same formula the movements of the largest bodies in the universe and those of the lightest atom. Nothing would be uncertain for him; the future as well as the past would be present to his eyes." "The human mind," he continues, "in the perfection it has been able to give to astronomy, affords a feeble outline of such an intelligence. Its discoveries in mechanics and in geometry, joined to that of universal gravitation, have brought it within reach of comprehending in the same analytical expressions the past and future states of the system of the world. . . . All its efforts in the search for truth tend to approximate it without limit to the intelligence we have just imagined." So wrote Laplace in 1812, and his words have been classic among men of science ever since. As one instance among many shewing in what sense they have been understood, I may mention the Leipzig Address to the Deutscher Naturforscher Versammlung by Émile du Bois-Reymond, an address that has made more stir in its way than Tyndall's Belfast Address of a year

* See Note i, p. 588.

or two later, which it seems to have inspired. "As the astronomer," said the Berlin professor, "has only to assign to the time in the lunar equations a certain negative value to determine whether as Pericles embarked for Epidaurus there was a solar eclipse visible at the Piræus, so the spirit imagined by Laplace could tell us by due discussion of his world-formula who the man with the iron mask was or how the *President* came to be wrecked. As the astronomer foretells the day on which — years after — a comet shall reëmerge in the vault of heaven from the depths of cosmic space, so that spirit would read in his equations the day when the Greek cross shall glance again from the mosque of St. Sophia or England have burnt her last bit of coal. Let him put $t = -\infty$ and there would be unveiled before him the mysterious beginning of all things. Or if he took t positive and increasing without limit, he would learn after what interval Carnot's Law will menace the universe with icy stillness. To such a spirit even the hairs of our heads would all be numbered and without his knowledge not a sparrow would fall to the ground." [1]

Despite these scriptural allusions, it would be a mistake to imagine any connexion between the knowledge of this Laplacean intelligence and Divine omniscience. How God knows, or even what knowledge means when attributed to the Supreme Being, few of us will pretend to understand. But this imaginary intelligence of Laplace knows, *as we know*, by calculation and inference based on observation. To God the secret thoughts of

[1] *Ueber die Grenzen des Naturerkennens*, 4te Aufl., p. 6.

man's heart are supposed to lie open; from this Laplacean spirit they would be forever hidden, were it not that he can calculate the workings of the brain. Human free will and divine foreknowledge have been held to be not incompatible: but free will and mechanical prediction are avowedly contradictory. Laplace therefore is careful to exclude free will. Before the future can be in this way deduced from the past, all motives must admit of mechanical statement and the motions of matter and its configurations be the sole and sufficient reasons of all change.

It would be a mistake again to confound this mechanical theory of the universe with doctrines such as those of Newton, Clarke, Butler, Chalmers, and other Christian apologists. They too refer to events in the material world as "brought about, not by insulated interpositions of divine power exerted in each particular case, but through the establishment of general laws."[1] But they none the less regard the laws and properties of matter as but "the instruments with which God works."[2] Such language may be open to serious criticism, but that just now is not the point. It is enough if we realise that whoever holds the notion of the Living God as paramount can never maintain that exact acquaintance with his instruments is enough to make plain all that God will do or suffer to be done. Thus Newton, at the close of his *Opticks*, declares that the various portions of the world, organic or inorganic, "can be the effect of nothing else than the wisdom and skill of a powerful

[1] Whewell, *Bridgewater Treatise,* 1847 edition, p. 356.
[2] *o.c.*, p. 357.

ever-living Agent who, being in all places, is more able by his will to move the bodies within his boundless uniform *sensorium*, and thereby to form and re-form the parts of the universe than we are by our will to move the parts of our own bodies." To men like Laplace and the French Encyclopædists, of course, this bold anthropomorphism would mean nothing; such strictly voluntary movement being for them a delusion. But coming from Newton, who did not regard man as a machine or conscious automaton, these words shew plainly that *he* would not have subscribed to the mechanical theory, although he laid what are taken to be its foundations.

I must confess to some surprise on finding Jevons, who must certainly be counted on the theistic side as a strenuous opponent of naturalism, nevertheless seeming to approve of Laplace's "mechanical mythology," as it has been called. "We may safely accept," says Jevons, "as a satisfactory scientific hypothesis the doctrine so grandly put forth by Laplace, who asserted that a perfect knowledge of the universe, as it existed at any given moment, would give a perfect knowledge of what was to happen henceforth and forever after. Scientific inference is impossible, unless we may regard the present as the outcome of what is past, and the cause of what is to come. To the view of perfect intelligence nothing is uncertain."[1] I must again repeat, that neither the intelligence conceived by Laplace, nor the knowledge attributed to it, is in any sense entitled to be called perfect. Laplace himself, though accounted hardly second to Newton as a mathematician, was hopelessly incom-

[1] *Principles of Science*, 2nd edition, p. 738.

petent in the region of moral evidence. After a few weeks in office as Minister of the Interior, his master Napoleon sent him about his business,[1] declaring him fit for nothing but solving problems in the infinitely little. His imaginary intelligence was only an indefinite magnification of himself, commanding an appalling amount of differential detail and possessed of the means of integrating it; but there is nothing to shew that the *in*capacity of this Colossus may not in other respects have been as sublime as his capacity for calculation. Jevons's inconsequence in accepting this Laplacean conceit is possibly due to a misunderstanding. A reference to Newton's first law of motion will make my meaning clear. When it is there said that a body *left to itself* perseveres in its state of rest or of uniform motion in a straight line, what is affirmed is a tendency, not a fact, for no body ever is left to itself. Similarly it might be said of the material universe, if *left to itself*, that its state thenceforth and ever after would be the outcome of its state at the given moment. So understood, Laplace's 'doctrine' would formulate a tendency, but would not assert a fact. That it is in the former sense that Jevons interprets it is plain, for he says expressly: "The same Power, which created material nature, might, so far as I can see, create additions to it, or annihilate portions which do exist. . . . The indestructibility of matter, and the conservation of energy, are very probable scientific hypotheses, which accord satisfactorily with experiments of scientific men during a few years past; but it would be a gross misconception of scientific inference to

[1] Whewell, *o.c.*, p. 338.

suppose that they are certain in the sense that a proposition in Geometry is certain."[1] But this was assuredly not Laplace's meaning; and from the illustrations used it was clearly not what Du Bois-Reymond understood him to mean. And lastly, it is certainly not in any such tentative and provisional sense that the mechanical theory now holds sway among scientific men and 'weighs,' as Huxley put it, 'like a night-mare' on the minds of many.

We are bound, I think, carefully to distinguish these two views: the one regarding the universe, so far at least as we can know it, as a vast automatic mechanism, and the other regarding the 'laws of nature' as but the instrument of Nature's God. But it is important to observe, too, that they have a certain common ground in the recognition of laws as 'secondary causes.' In this the naturalism of modern science and the supernaturalism of popular theology are so far at one; although the naturalist stops at the laws, and the theologian advances to a Supreme Cause beyond them and distinct from them. Now, it is, I think, inevitable, so far as the question of theism is argued out from such premisses, that theism will get the worst of it. Unquestionably it has had the worst of it on these lines so far; of this we noted many instances in the last lecture. Not a few temples to the Deity founded on some impressive fact supposed to be safely beyond the reach of scientific explanation have been overtaken and secularised by the unexpected extension of natural knowledge. Chalmers's now classic distinction between

[1] Jevons, *o.c.*, p. 766.

the laws and the collocation of matter, familiar at least to every reader of Mill's *Logic*, may serve to illustrate this point. "The tendency of atheistical writers," says Chalmers, "is to reason exclusively on the laws of matter, and to overlook its dispositions. Could all the beauties and benefits of the astronomical system be referred to the single law of gravitation, it would greatly reduce the strength of the argument for a designing cause."[1] "When Professor Robison felt alarmed by the attempted demonstration of Laplace, that the law of gravitation was an essential property of matter, lest the cause of natural theology should be endangered by it, he might have recollected that the main evidence for a Divinity lies, not in the laws of matter, but in the collocations."[2] "Though we conceded to the atheist the eternity of matter and the essentially inherent character of all its laws, we would still point out to him, in the manifold adjustments of matter, its adjustments of place and figure, and magnitude, the most impressive signatures of a Deity."[3] But what would become of this 'main evidence for a Divinity' if the laws of matter themselves explained its collocations? They can never explain them completely, of course. Till a definite configuration is given him the physicist has no problem; but with such data he professes to deduce the motions and redistributions that according to the laws of matter must ensue. So, if science by the help of these laws should trace the course of the universe backwards, it must halt at some

[1] *Bridgewater Treatise*, vol. i, p. 17.
[2] *o.c.*, p. 20, *note*. [3] *o.c.*, p. 21.

configuration or other; and of the configuration at which it halts it can give no account. "The laws of nature," says Chalmers, "may keep up the working of the machinery — but they did not and could not set up the machine."[1] This final configuration reached by the scientific regress, then — let it be noted — is "the machine." That — provisionally at all events — science cannot explain; so much is true. But meanwhile two things are noteworthy. First, in innumerable cases, as I have said, what was formerly taken to be part of the machine turns out to be due to the workings of its machinery. Secondly, as a consequence of this, those constructive interventions, which are held "to demonstrate so powerfully the fiat and finger of a God," become rapidly fewer in number, and recede farther and farther into the deep darkness of the infinite past. It was surely a short-sighted procedure to rest the theistic argument on a view of nature that must inevitably reduce the strength and diminish the impressiveness of that argument at every advance of natural science. When, too, those who adopt such a line of reasoning themselves allow this fatal weakness, as we have seen that Chalmers did, the proceeding becomes almost fatuous. Indeed, it would hardly be an exaggeration to say that the naturalism of to-day is the logical outcome of the natural theology of a century ago. I do not forget a rejoinder on the old lines that one frequently hears now that the theories of Lyall and Darwin and Spencer are supposed to have become established truths — a sort of *dernier ressort* where

[1] *Bridgewater Treatise*, vol. i, p. 27.

direct attacks have failed. After all, it is said, the more a machine can direct itself and repair itself the more wonderful its first construction must have been. To have so created and disposed the primal elements of the world as to insure by the steadfast working of unvarying laws the emergence in due time of all the life and glory of the round ocean and the teeming earth, is not this after all "the most impressive signature of a Deity"? This seems to me very like asking whether, after all, infinity times nothing is not greater than *n* times *m*? In other words such an argument points logically either to the machine being nothing and God all, or to God being nothing and the machine everything. But which? That depends where we start: if from God, the machine is throughout dependent; but if from the machinery, we may never reach God at all. For the avowed pantheist, who knows neither secondary laws nor machinery, it is, of course, God that is all.

> "That God, which ever lives and loves—
> One God, one law, one element,
> And one far-off divine event."

For those, on the other hand, anxious, perhaps, like Chalmers, to keep clear of what he calls 'the metaphysical obscurity' concerning the origination of matter and its essential properties, and content to "discern in the mere arrangements of matter the most obvious and decisive signatures of the artist hand which has been employed in it,"[1] for such, it is God that vanishes.

[1] *Bridgewater Treatise*, vol. i, p. 25.

Logically and actually on their premisses we find in the words of Huxley already quoted "that matter and law have banished spirit and spontaneity."[1]

This then is the Laplacean conception that we have first to examine, and if it lead us in the end into 'metaphysical obscurity,' let us be warned not to shrink from the task. In the beginning, however, it will rather be certain physical commonplaces that must claim our attention. As to these it behoves me to say at once and emphatically that I make no pretence to special knowledge. But I shall take care to refer to nothing — unless it be generally known — without expressly mentioning my authority.

First of all, it will be remembered that Laplace regarded the universe as composed of a number of beings having assignable positions and movements, and ranging in size from the largest celestial bodies down to the lightest atoms. He assumed that all these, whether masses or molecules, whether of finite or of infinitesimal dimensions, are amenable to the same mechanical laws; and this assumption is still regarded as "the axiom on which all modern physics is founded."[2] None the less there are some striking differences in the methods followed in the two cases, *i.e.* according as the masses to be dealt with are of sensible or of insensible dimensions. With sensible masses the physicist's procedure is in the main *abstract*, and any exactness he may attain is attained in this manner. But he at least knows the bodies he is investigating, say the sun or the moon, the bob of a

[1] Cf. above, Lecture I, p. 17.

[2] J. J. Thomson, *Applications of Dynamics*, p. 1.

pendulum or the screw of a steamship. In dealing with molecules or atoms, on the other hand, such identification and individualisation is impossible. His procedure here, if I may so say, is predominantly *idealistic.* Actual perception is replaced by ideal conception. Moreover, the ideal atoms or molecules are often wholly hypothetical, and when not this — as in chemistry, perhaps — are still rather statistical means or averages than actual existences. Further, the exactness which it is known cannot be affirmed of mechanisms of sensible mass, except after manifold abstractions, is assumed, not unfrequently, to apply *literally* to the hypothetical mechanisms of which atoms and molecules and other ideal conceptions form the working parts. We shall thus have to consider the abstract theory first in itself, next in its application to sensible masses, and lastly in its application to insensible masses.

First, as to the *abstract method.* A few sentences from a standard text-book will make clear what is meant by this. In Thomson and Tait's *Natural Philosophy* the division entitled *Abstract Dynamics* begins as follows: —

"Until we know thoroughly the nature of matter and the forces which produce its motion, it will be utterly impossible to submit to mathematical reasoning the *exact* conditions of any physical questions. . . . Take, for instance, the very simple case of a crowbar employed to move a heavy mass. The accurate mathematical investigation of the action would involve the simultaneous treatment of the motions of every part of bar, fulcrum, and mass raised; but our ignorance of the nature

of matter and molecular forces, precludes any such complete treatment of the problem. . . . Hence, the idea of solving, instead of the complete but infinitely transcendent problem, another in reality quite different, but which, while amply simple, obviously leads to practically the same results as the former, so far as concerns . . . the bodies as a whole. . . . Imagine the masses involved to be *perfectly rigid*, that is, incapable of changing form or dimensions. Then the infinite multiplicity of the forces really acting may be left out of consideration." After some further elucidation the writers conclude: "Enough, however, has been said to show, *first*, our utter ignorance as to the true and complete solution of any physical question by the only perfect method, that of the consideration of the circumstances which affect the motion of every portion, separately, of each body concerned; and, *second*, the practically sufficient manner in which practical questions may be attacked by limiting their generality, *the limitations introduced being themselves deduced from experience*."

The method above referred to as 'the only perfect method,'—in which the motions of every particle concerned are taken into account—is obviously the very method that Laplace's imaginary spirit is supposed to apply to the universe. We seem meant to assume that this method is *not* abstract—a very questionable assumption to which we shall be brought back later. Meanwhile, turning to the confessedly abstract method with which the actual physicist has to content himself, let us note in what respects the simple question he actually solves differs from the concrete and really

quite different question that is propounded. This refers to a particular crowbar, a particular fulcrum, and a particular material body to be raised at a particular place and date. Assuming that raising the load at a given place means moving it against the gravitational forces at that place, — though in fact these will not be the only forces concerned, — we shall be told that the answer to the question on this score alone will in general vary for every different place, and even, in general, at every different date. But abstract dynamics knows nothing of places and dates; these are the affair of topography and chronology: it knows only of abstract space, time, and motion, as dealt with by geometry and kinematics. Accurately to ascertain the actual forces existing at any place or time would require precise measurements of a complex kind, and precise measurement in the simplest case is, strictly speaking, an impossibility. Abstract dynamics is a mathematical science and therefore does not measure; there would be an end of all exactness if it did. We should be requested accordingly to *state* what the weight of the load is, or at any rate what it may be taken to be. For the same reason the lengths of the two arms of the lever must be *given*, then the power to be applied can be found. Let us next suppose that the lever is made of lead or of lancewood, and that the load consists of dynamite, sheet-glass, or putty. The exponent of abstract mechanics will object again: You are proposing here millions, nay billions, of problems, instead of one. The properties of the lever as a simple machine being in question, we are entitled to replace the

material crowbar by a line of equal length fixed at the point answering to the fulcrum, and to regard it as unalterable in form and dimensions. And as to the load, dynamics can deal only with the mass of that; it does not recognise the qualitative differences of material bodies. "In abstract dynamics"—to quote Maxwell—"matter is considered under no other aspect than as that which can have its motion changed by the application of force. Hence any two bodies are of equal mass if equal forces applied to these bodies produce, in equal times, equal changes of velocity. This is the only definition of equal masses which can be admitted in dynamics, and it is applicable to all material bodies, whatever they may be made of."[1]

The gulf between this final abstraction of 'mass' and the material bodies which it replaces is so great that even the physicists to whom it is due often fail to realise how much they have stripped off. The notion of mass leaves far behind it not merely all the diversities of chemical classification, where iron and carbon, oxygen and chlorine are placed wide apart; not merely the variety of secondary qualities, colour, taste, smell, and the like, whereby sensible objects are commonly described; not merely the physical distinction of solid, liquid, and gaseous states, in one or other of which all material bodies are found. A mass has no chemical nature, no physical properties, not even a weight. Even its relation to space differs from that of sensible bodies. Matter has often been defined as that which can, or that which must, occupy space.

[1] *Matter and Motion*, p. 40.

Whatever these definitions may be worth, they cannot at all events be applied directly to mass as just defined. A mass must have position or it could not be moved, but it may be of finite amount and yet have no size, or it may be of any size whatever. It is true that all bodies of sensible dimensions are found to resist compression, or deformation, or both. But these characteristics are due not to mass, but to forces. Moreover, when such changes in the configuration of a body are under investigation, the body is regarded as a system of mass-elements or mass-points, and these either as continuous or discontinuous, as circumstances may determine. Inasmuch, however, as changes of configuration are conceivable in every material body of finite dimensions, the logical implication is that all such bodies consist of mass-points. Thus the question whether matter is discrete, consisting ultimately of atoms, or is continuous and so indefinitely divisible, is not a question that concerns mass. Indeed, not only may a mass of finite volume be divisible as long as that volume itself is divisible; but even if we suppose ourselves to have reached the geometrical point or limit of spatial divisibility, which has neither parts nor magnitude, this puts no limit to the divisibility of mass. As already said, such a geometrical point may be regarded as the seat of a mass that still has both parts and magnitude. "In certain astronomical investigations," as Maxwell points out, "the planets, and even the sun, may be regarded each as a material particle,"[1] or mass-point. Yet these masses require a very great

[1] *Matter and Motion*, art. vi, p. 11.

number to express them when our customary units of mass are used. On the other hand, "even an atom, when we consider it as capable of rotation, must be regarded as consisting of many material particles" or mass-points — although its total mass in gravitation measure be less than the billionth part of a gramme.

But all this will become plainer, and the extreme abstractions involved in the notion of mass more apparent, if we recur again to its definition, regarding it this time synthetically rather than analytically. It is possible to describe the motions of points or figures and the composition or resolution of such motions in a purely formal manner, just as in geometry their situations and constructions are formally described. In this way kinematics, as the science of abstract motion, covers all the ground implied in change of position or change of speed in any body or system of bodies, so far as such motion involves only pure or abstract space and time. By abstract space and time, it need hardly be said, is meant, as I have already incidentally remarked, the space and time of mathematics, not the variously filled space and time of our concrete perceptual experience. Kinematics is then in the strictest sense a branch of pure mathematics, and not an empirical science. But we pass, it may be supposed, from the mathematical to the real, when, in place of merely describing motion, we ask what is moved and what are the causes of such actual motion. The categories of substance and cause here seem to come upon the scene, and they surely transcend the range of the purely mathematical. But is mass conceived by abstract mechanics as a thing or

substance; or is force conceived as a cause? The answer, I think, must be negative to both questions. But deferring the question as to force, it must be noted that mass is by no means synonymous with matter, though sometimes used as if it were. "We must be careful to remember," Maxwell tells us, "that what we sometimes, even in abstract dynamics, call matter, is not that unknown substratum of real bodies against which Berkeley directed his arguments, but something as perfectly intelligible as a straight line or a sphere." "Why, then," he asks, "should we have any change of method when passing from kinematics to abstract dynamics? Why should we find it more difficult to endow moving figures with mass than to endow stationary figures with motion? The bodies we deal with in abstract dynamics are just as completely known to us as the figures in Euclid. They have no properties whatever except those which we explicitly assign to them."[1] In entire accord with this we have the statement of Professor Tait, — all the more impressive because of his well-known hankering after the metaphysical, — that "we do not know and are probably incapable of discovering what matter *is*."[2] Matter as substance is, in short, as rigorously excluded from modern physics as mind, as substance, is banished from modern psychology; indeed, matter is not merely excluded but abused as a 'metaphysical quagmire,' 'fetish,'[3] and the like.

[1] Review of Thomson and Tait's *Natural Philosophy*, in *Nature*, vol. xx, p. 214; also *Scientific Papers*, vol. ii, p. 779.

[2] *Properties of Matter*, art. xx.

[3] Cf. Karl Pearson, *Grammar of Science*, passim.

In dealing with mass, then, we are only dealing with a property; and, since it is a property that varies continuously in quantity, it is one that admits of mathematical treatment. Mass, in short, is but another name for quantity of inertia. By inertia the physicist denotes the fact, or to be strictly accurate I should say the well-grounded inference, that a body, so long as it is left to itself, preserves strictly in respect of motion its *status quo*. We can perfectly well imagine any number of such bodies of the most various sizes and shapes moving severally in all possible directions, and all at different speeds, that of zero speed or rest being one. Referred to some defined origin and axes, their apparent changes of size, shape, relative position after a given interval, as well as their apparent changes of speed, could all be dealt with by kinematics. Such motions, in accordance with Newton's First Law, might be called, perhaps have been called, free, or independent, or unconstrained motions. But this is not all that kinematics could do. We might arbitrarily assign to any or all the bodies under contemplation any deviations from uniform rectilinear motion or from rest; and the resulting positions after a given interval might still be found as before. Such deviation from uniform rectilinear motion or from rest is, of course, in actual fact the rule; and the kinematical problems of abstract dynamics — if I might so call them — differ from such arbitrary problems only in not being arbitrary. "The new idea appropriate to dynamics (then) is" — I quote Maxwell — "that the motions of bodies are not independent of each other, but that, under certain conditions, dynamical transactions take place

between two bodies whereby the motions of both bodies are affected." [1]

Now one of these conditions is that the said transactions between two bodies — as Maxwell picturesquely calls them — are in no ways affected by, and in no ways affect, other dynamical transactions which either or both the bodies may have with other bodies. In a word, the results of all such transactions are *additive*. All the principles involved may therefore be learnt by considering such a transaction in a single case. Another condition is that such transaction between two bodies takes place along the line joining them; also, that the changes of motion or the accelerations of each body along this line, in which the said transaction or mutual stress consists, are in opposite directions. But how far is each to shunt from its original direction, how much is each to alter its original speed, that is to say, what share in the whole transaction is each to take? *The answer to this question gives the meaning of mass.* To each body a number is to be assigned, such that the changes of their motion are inversely proportional to these numbers. Such number answers to the mass of the body to which it belongs. Its determination, of course, in any real case involves measurement, and is the business, not of abstract dynamics, but of experimental physics. The actual number again depends on the standard employed, but, once so determined, by dynamical transaction with the standard, it is determined once for all for every other dynamical transaction with other masses numbered according to the

[1] *Nature, l.c.*

same unit. The appropriateness of defining mass as quantity of inertia, *i.e.* as the measure of that tendency to persistence of the motor *status quo* which preceded the particular dynamical transaction under investigation, is thus evident. For the greater the mass, the less in any given case the change of motion that ensues; the less the mass the greater the change of motion — kinematically estimated, of course. Thus, if the mass of one of the two bodies is infinite, its kinematic circumstances are unaltered; if the mass of one be zero, that of the other, however small, undergoes no acceleration; where both are equal, the accelerations of both are equal; and so for every other case. So far then from falling under the category of substance, a mass as it occurs in abstract dynamics is but a coefficient affecting the value of the acceleration to which it is affixed. True the phrase "*mass of a body*" is constantly recurring; but then the body, apart from the mass, is but a moving point or figure.

There still remains the correlative term Force. How, it may be asked, can the bodies of abstract dynamics be conceived as merely geometrical figures moving according to rule, if they are collectively endowed with all the forces of nature: gravitation, light, heat, electricity, chemical attraction, etc.? What are these if they are not the active properties of material bodies? The investigation of the nature of matter or of the properties of real bodies, we shall be told, is entirely the business of experimental physics; abstract dynamics takes account of no properties but those expressed by its definitions. But by definition a body is endowed with

no essential properties but mass and mobility. Force, as understood by dynamics, cannot then be an inherent and permanent property of any given body, dynamically considered. On the contrary, no mass, though infinite, has any force by itself. A force in the dynamical sense cannot appear till there are two masses in dynamical relation, and then there will be two equal and opposite forces, let the masses differ as much as they may. A force is but the name for a mass-acceleration, *i.e.* for either side of the dynamical transaction between two bodies, which we have already considered; and a moment's recurrence to that transaction will make the purely mathematical character of such forces plain. Instead of the moving geometrical point of kinematics, we have in dynamics a mass-point in motion. This mass-motion for a given direction is called momentum; momentum being the product of the number of units of mass into the number of units of speed. It remains, so long as the body is left to itself, a constant quantity. When two masses are said to interact, the momentum of each changes, and the rate of this change for one of the bodies is called the moving force on that body; this again is a quantity, the product, as said, of mass into acceleration. In short, the old qualitative definition of force as "whatever changes or tends to change the motion of a body" is discarded by modern dynamics, which professes to leave the question of the causes of such change entirely aside. *Force for it means simply the direction in which, and the rate at which, this change takes place.* It answers, says Kirchhoff, in mathematical language to the second differen-

tial coefficient of the distance as a function of the time; is, as Tait puts it, no more an objective entity than say five per cent per annum is a sum of money.[1]

How completely the theory of mechanics has divested itself of the conceptions of substance and cause, in assuming its present strictly mathematical form, is brought home to us by one striking fact; the fact, I mean, that mass and force, in which these categories are supposed to be implied, are but dependent variables in certain general equations. In $7+5=12$ or $\tan 45°=1$, we cannot say that one side of these equations is more than the other effect or consequent, that other being the cause or essence whence it proceeds. It would be equally arbitrary to attempt any such distinction when we have the equation $mv=Ft$, or $ms=Ft^2/2$ or $Fs=mv^2/2$. In these, the fundamental equations of dynamics, we have four quantities so connected, that if any three are known the fourth can be found. In this respect one term is no more real than another, and the dependence is not temporal or causal or teleological, but mathematical simply. The sole use of such equations, it is contended, is "to *describe* in the exactest and simplest manner such motions as occur in nature." So Kirchhoff defined the object of mathematical physics in his universally lauded textbook, and his definition has recently been made the motto of a manifesto on the part of Professor Mach. "It is said," Mach remarks, "description leaves the sense of causality unsatisfied. In fact, many imagine they understand motions better when they picture to themselves pulling forces, and yet the *accelerations*, the

[1] Cf. Tait on *Force*, *Nature*, vol. xvii, p. 459.

facts, accomplish more, without superfluous additions. I hope that the science of the future will discard the idea of cause and effect, as being formally obscure; and in my feeling that these ideas contain a strong tincture of fetishism, I am certainly not alone."[1]

I am quite aware that the elimination from natural science, of this so-called fetishism, which the categories of substance and cause are supposed to involve, has been gradual.[2] But the history of mechanics shews conclusively that there at any rate this process of elimination has been steady, and now at length seems to be complete. The full significance of this deanthropomorphic tendency of science it will be best to defer, along with other epistemological reflexions, till we have reached the end of this survey of the cardinal doctrines of modern science, which we have but just commenced. At this stage I will only venture the remark that those who seek to oppose this tendency—as Wundt and still more Sigwart, for example, seem to do—appear rather to mistake the issue. It is not a question of divesting the human mind of its most fundamental conceptions; it is simply a question of method and expediency, the propriety, in a word, of dividing natural science from natural philosophy. No doubt many of those who insist on this separation are privately of opinion, as we have seen,

[1] *Popular Scientific Lectures*, Eng. trans., 1895, p. 253.

[2] Even in the time of Newton forces were regarded as powers inherent in substances. Their *effects* could be measured, but not the forces themselves. Still earlier the *remora* or *echineis*, though but a "little fish," was credited with the power of stopping a ship by merely adhering to it. Cf. Whewell, *History of Inductive Sciences*, 3rd edition, vol. i, p. 189.

that natural science will make a whole of knowledge by itself. But in so thinking they are only playing the amateur philosopher. Such a declaration is no part of their business as scientific experts. As Mr. Bradley roundly puts it: "When Phenomenalism loses its head and, becoming blatant, steps forward as a theory of first principles, then it is really not respectable. The best that can be said of its pretensions is that they are ridiculous."[1] The sharper the division of labour, the more fragmentary becomes the contribution of each separate worker; but the more perfect also the finished production of their joint organisation. The 'ragged edges' of scientific knowledge ought to become more apparent the more strictly scientific they are; and the more defined these ragged edges are, the more effectively can philosophy enter upon the work it aspires to do, of articulating or connecting those sutures, of rounding off and unifying the whole.

No wonder Laplace could dispense with the hypothesis of a Deity, if his celestial mechanics turn out to be so abstract as to exclude the categories of substance and cause. A mathematical formula does not change its essential character by increasing in length and complexity. If the validity of an equation is by its very definition confined to what is mathematical, if it is only tentatively and approximately applicable to what is real, Laplace's world formula must be like the rest. On this question of the relation of abstract dynamics to actual phenomena, I propose to enter in the next lecture.

[1] *Appearance and Reality*, p. 126.

LECTURE III

RELATION OF ABSTRACT DYNAMICS TO ACTUAL PHENOMENA

The characteristics of Abstract Dynamics recapitulated.

The question raised: How far, and in what sense, this science can be applied to actual phenomena. *This problem illustrated from Newton's treatment of Space, Time, Motion, as* (1) *absolute;* (2) *relative.*

Bearing of this distinction on the attempt to determine an actual case of the first law of motion. Various proposals considered. The question of absolute rotation especially instructive. Mach's criticisms reveal the indefinite complexity of 'real cases.'

The mechanical theory is thus divided against itself: it cannot be at once rigorously exact and adequately real. The Kirchhoff School abandon the attempt "to penetrate to the mechanism of nature," and see in mechanics only an instrument for 'approximate description.' Unconditional mechanical statements concerning the real world appear so far unwarrantable.

One of these specially discussed: the Conservation of Mass. *Mr. Herbert Spencer's 'short and easy method' found wide of the mark. This doctrine, like other mechanical doctrines, justified mainly by its simplicity.*

We resume to-day the attempt to estimate the validity and the scope of the mechanical theory of the universe. To understand this we have had first of all to inquire into the precise import of the science of abstract mechanics or dynamics, on which that theory is avowedly founded. We have accepted the declaration of mathematical physicists in the present day that it is not the province of mechanical theory to explain

phenomena by means of natural forces, but only to describe completely in the simplest possible manner, such motions as occur in nature.[1] We appreciate most readily the distinctive character of pure mechanics, as thus defined, if we approach it from the side of kinematics. Kinematics is held to suffice for the description of any actual or possible motion of bodies, regarded as moving figures of constant or varying shape. If there are some motions too complex for kinematic treatment in the present state of that science, the defect is one that mechanics can do nothing to remove. But "the motions that occur in nature" are frequently, and, it is supposed, are always, mutually dependent. As to the character of this dependence, the most various hypotheses might be — indeed have been — formed; and when such hypotheses are sufficiently definite, as regards their space and time elements, their kinematical consequences can be deduced. The kinematical problems thereby entailed *might* be appalling in comparison with those required by the simple assumptions

[1] It may be objected that such 'simplest possible description' is itself explanation, that in fact explanation is merely resolving the complex into the simple, and assimilating the less known to the better known. I admit this fully. But experience is not restricted to the range of exact science, and so far it is true that a fact is not fully explained if its cause is unknown. (Cf. below, Lecture XIX.) Precisely in this lay the difficulty for such men as Huygens, Leibnitz, and Bernoulli of Newton's theory of gravitation. Newton only professed to 'describe,' but, as Lange tersely puts it: "These men could not separate the mathematics from the physics, and physically the doctrine of Newton was for them inconceivable." And so it has remained till this day, although people are now accustomed to regard Newton's descriptive conception as if it were itself a physical cause.

to which, after many trials, Galileo, Huygens, and Newton, the founders of modern dynamics, were led. By means of the conception of mass the notion of quantity of motion, or momentum, was made definite by Newton, and the so-called laws or axioms concerning momentum formulated. According to these the rate at which their momentum changes, when two masses are in the state of mutual stress, is always equal in amount, their motions taking place in opposite directions along the line joining them, the result being that the momentum of their common centre of mass remains unchanged.

Nothing could be more sublimely simple, especially when it is remembered that these axioms involve the so-called parallelogram of forces; imply, that is, that the mutual accelerations of any two masses are uninfluenced by the presence of a third mass. Such is abstract dynamics; and, regarded from within, its exactness is as impressive as its simplicity. Not only is it clear of such 'bottomless quagmires' as substantiality and causality, conceptions which no *science* has ever yet adjusted to facts; but as 'rational mechanics'[1] it is clear, too, of all induction and all experiment, resting wholly, as truly as any formal science does, on its own fundamental definitions and axioms. The only space or time or motion that it knows is what Newton called absolute, true, and mathematical, and sharply distinguished from the relative spaces, times, and movements of our perceptual experience.

How far, and in what sense, this pure mechanical science can be applied in the phenomenal world is now for us the

[1] Cf. Newton's Preface to the *Principia*.

vital question. Unhappily the authorised teachers of physics seem only recently to have waked up to the possibility of such a question at all. The only 'applied mechanics' they seem aware of is that of the mechanician and the engineer. While admitting readily that the astronomer applies geometry and trigonometry in his investigations, they talk as if he were entirely in the region of pure theory as soon as he proceeds to discuss celestial movements. Newton at all events knew better than this, even if he realised the difficulty of the transition less than many now do. Let me quote a few sentences from the *Principia* in illustration.[1] First, as to *time:* "Absolute, true, and mathematical time, in itself, and from its own nature, flows equally, without relation to anything external; and by another name is called Duration. . . . The natural days are truly unequal, though they are commonly considered as equal and used for a measure of time. Astronomers correct this inequality that they may measure the celestial motions by a more accurate time. It may be that there is no equable motion, whereby time may be accurately measured. All motions may be accelerated and retarded; but the flowing of absolute time is liable to no change. Duration . . . remains the same, whether motions are swift or slow or none at all: therefore this duration is properly distinguished from its sensible measures; and from them it is collected by means of an astronomical equation."

Again, as to *space:* "Absolute space, in its own nature, without relation to anything external, remains

[1] Cf. Pemberton's translation, pp. 10 ff.

always similar and immovable." "For the primary places of things to be moved is absurd. These are therefore absolute places; and translations only out of these are absolute motions. But, because the parts of space cannot be seen, or distinguished from one another by our senses, therefore in their stead we use sensible measures . . . and that without any inconvenience in common affairs: but in philosophical disquisitions, we must abstract from the senses. For it may be that no body is really at rest, to which the places and motions of others may be referred. . . . It is possible that in the regions of the fixed stars or far beyond them, there may be some body absolutely at rest; but yet [it is] impossible to know from the position of bodies with respect to one another in our regions, whether any of them do keep the same position to that remote body or no. It follows [therefore] that absolute rest cannot be determined from the position of bodies with respect to each other in our regions."

Lastly, as to *motion:* "Absolute motion is the translation of a body from absolute place to absolute place; and relative motion is the translation from relative place to relative place." "If a place is moved, whatever is placed therein is moved along with it. . . . Therefore all motions which are made from places in motion, are only *parts* of entire and absolute motions: and every entire motion is composed of the motion of the body out of its first place, and of the motion of this place out of its place, and so on, until we come to some immovable place, as in the example of the sailor before mentioned [who was supposed to move relatively

to his ship which moved relatively to the earth, which in turn moved relatively to the sun, and so on and on]. Wherefore entire and absolute motions can be no otherwise determined than by immovable places. . . . It is indeed a matter of great difficulty to discover and effectually to distinguish the true motions of particular bodies from the apparent: because the parts of that immovable space, in which motions are truly performed, do not come under the observation of our senses. Yet the case is not *altogether desperate;* for arguments may be brought, partly from the apparent motions, which are the differences of the true motions; partly from the forces, which are the causes and effects of true motions."

One can readily gather from statements like these that Newton saw no difficulty in working out problems in which the time should flow at a constant rate, and in which motion from absolute place to absolute place was at once and effectually determined. The position of mechanical theory is in this respect precisely on a par with that of geometry. The description of the circle, say, is easy and exact, but accurately to describe the figure of any real object is an impossibility. So it is with the fundamental quantities concerned in physics.

It is impossible to find in nature or artificially to construct an accurate timekeeper. The physicist simply has to collect the true time from its 'sensible measures,' to use Newton's phrase, as nearly as he can. Experience provides us with innumerable instances in which processes seemingly identical in character and severally independent, are again and again repeated in such wise

that the number of repetitions of one kind of process is found to bear an approximately constant ratio to the number of repetitions of another and contemporaneous series. The solar day, the lunar month, the solar year, so far as we may regard them as independent events, are instances of such isochronous series of the natural sort; the periods of waves of light or of waves of sound are other instances; while the vibrations of a given spring or a given pendulum are cases of artificial isochronous events. The comparison of a number of such series — aided by dynamical reasoning, whereby certain disturbances can be ascertained and corrected, and aided again by the theory of probability in eliminating errors of observation — results not in the attainment of a measure flowing equably without regard to anything external, but in the best mean value possible in our restricted circumstances. Between such mean time and absolute time there is a difference, that is certain; and that difference is, for the mechanical theory, of the nature of error or defect. It is immaterial to the question we have in hand whether absolute time is also real or is ideal only. It is at least ideal, and the fact that the physicist has to leave this ideal behind him when he proceeds to apply abstract dynamics to natural phenomena is the fact to be noted.

Turning to space, the same fact meets us again. Instead of the immovable space, the fixed axes, the primary places of mathematical theory, we have that indefinite regress from relative place to relative place, which renders the attempt to ascertain the so-called true motions of particular bodies, as Newton allows, "well-nigh desperate." Consider, for example, a case falling under

the first law of motion. According to this law the motion of a body free from external forces is uniform in magnitude and direction. The mathematician has no trouble with this. He can always specify the axes to which he refers, and plot out diagrams of velocity in his paper space. But when we pass to empirically given space, where is the place to which the direction of a body moving under the action of no forces is referred? "A number of writers," says Professor MacGregor in a recent article, "have attacked this problem, and left it only half solved."[1] Newton's forlorn suggestion that possibly in the region of the fixed stars, or far beyond, there may be a body absolutely at rest, to which the positions and motions of others may be referred, has been revived. In favour of assuming this fictitious Body Alpha, as it has been called, it is urged that such a body provides an escape, in thought at all events, from the hopeless confusion of relative motions to which there is no end.[2] But *ideally* this Body Alpha is not wanted, and *practically* it is useless. Another and less chimerical method that has found more favour begins, not by asking for a body absolutely at rest as a fundamental point of orientation, but by asking for an "inertial system." To constitute such a system it suffices to have three particles projected at the same instant from one position, and each left free to move, uninfluenced by force. Then, provided they do not all move in one straight line, it is geometrically possible to find axes, referred to which they will all three

[1] *Hypotheses of Dynamics, Phil. Mag.*, 1893, vol. 36, p. 237.

[2] Cf. Sigwart, *Logic*, § 88, 8; and Riehl, *Der philosophische Kriticismus*, Bd. II. i. pp. 92 ff.

move in straight lines. Referred to such a system, the path of any fourth body moving free from force will be a straight line.[1] But this again is obviously theoretical, and so far superfluous. Practically it is as impossible to ascertain that a body is absolutely free from forces as it is to ascertain its direction relatively to the Body Alpha, the presumption being indeed that no such body, unless it be the universe as a whole, exists. Yet a third method has been proposed of answering the question: Relatively to what, is a body free from constraint moving uniformly in a straight line? The answer according to this method, which has been adopted by Professor Tait, is, "Relatively to any set of lines drawn in a rigid body of finite dimensions, which is not acted on by force, and which has no rotation."[2] Here again it may be objected that it is impossible to find such a body, for if the universe is a single mechanical system, there is no such body to find.

But none the less this method brings to our notice a topic keenly canvassed nowadays among physicists, which is of extreme interest; so that I trust I may be pardoned for meddling with it. Newton believed that he had shewn, first by experiment, and then by theoretical reasoning, that "there is," as he puts it, "only one real circular motion of any revolving body . . . whereas relative motions in one and the same body are innumerable." Thus, if two bodies in an immeasurable void were found to approach, there would be no means of determining which was moving. But if the two bodies were con-

[1] Cf. L. Lange, *Die geschichtliche Entwicklung des Bewegungsbegriffes*, 1886, p. 139.

[2] *Properties of Matter*, p. 92.

nected by a cord, it would be possible, though their distance remained unchanged, to determine whether they were revolving or not. To settle this question it would be sufficient to ascertain the presence or absence of tension in the cord. Accordingly it is argued, as by Professor Tait, that a body *not* rotating will provide us with fixed directions in space, constitute a sort of absolute compass, so to say; and by the help of Newton's physical test it can be ascertained whether a body has rotation or not. Here, then, we seem to have something absolute, an exception to the supposed invariable relativity of everything phenomenal. But so far we have been given only a purely hypothetical case — a single system in an immense void. Newton's actual experiment consisted in rotating a bucket of water by strongly twisting a cord suspending it, so as to make the bucket spin rapidly. At first, when the bucket alone rotates, the surface of the water remains flat, although relatively to the bucket it is not at rest; whereas, by the time the water revolves along with the bucket its surface has become concave, thereby evidencing "real circular motion," to use Newton's phrase, notwithstanding that the bucket and the water by this time are at rest relatively to each other. Finally, when the bucket has ceased to revolve, the surface of the water continues concave some while longer, because "its endeavour to recede" from the axis has not yet ceased. "Therefore," says Newton, "this endeavour does not depend upon the translation of the water in respect of the ambient bodies, nor can true circular motion be described by such translation." In other words, as Kant remarks, "a motion which is a change of exter-

nal relation in space can be given empirically, although this space itself is not empirically given, and is no object of experience — a paradox deserving to be solved." Kant's own solution is of interest in its way, but it does not help us much, for it leaves the paradox in the main as he found it. But I will ask your attention instead to the much more trenchant criticism of Mach, as this will serve to illustrate the epistemological difference between abstract science and its empirical application, which is our immediate theme.

First of all let us note the difference between Newton's theoretical instance and his experimental one. In the purely hypothetical case we imagine a single mass system in an immense void, and it is shewn under what circumstances, provided the Newtonian laws of motion are assumed, the rotation of such a system could be demonstrated. In the real case, which is meant to verify this deduction, we are confined entirely to experimental methods. But now in this case, over and above the rotating mass of water, we have not only the mass of the bucket, but we have also the masses of the earth, of the rest of the solar system, and of the so-called fixed stars. Now, says Professor Mach, "Newton's experiment . . . only shews us that the rotation of the water relative to the sides of the bucket occasions no perceptible centrifugal forces, but that such forces *are* occasioned, when the water rotates relatively to the masses of the earth and the other heavenly bodies."[1] Experimental canons then at once suggest

[1] *Die Mechanik in ihrer Entwicklung*, 2te Aufl., pp. 216 f. There is now an English translation of this most interesting book.

two further inquiries: Might not the rotation relative to the bucket have some effect if the sides of the bucket were enormously increased in thickness? Or again — allowing for the moment that the proposition is not absurd, at least not kinematically absurd — supposing the bucket to be fixed and the whole choir of heaven to circle round it, would there then be no sign of rotation in the water? Such experiments being impracticable — for, as Mach well says, "the universe is not presented to us twice, first with the earth at rest and then with the earth rotating" — we are left to content ourselves, as best we can, with this result: that a body with so-called absolute rotation is a body rotating relatively to the fixed stars; and that a body without rotation means a body directionally at rest, *not absolutely*, but relatively to the fixed stars.

Returning now for a moment to Newton's hypothetical case, it is obvious that a physicist actually confined to such a system, before he could begin experimentally to apply or to verify the Newtonian laws of motion, would find himself face to face with the very difficulties we have considered. Positions and directions must be independently determined before dynamical investigations are begun. To assume the laws of motion in order to fix directions and then to use these directions in order to establish the laws would be obviously fallacious. From such a logical circle *abstract* dynamics is free, because the physicist has here the complete command of ideal space, as is shewn by his diagrams on paper; and because he has not to prove the laws of motion, but merely to deduce their theoretical conse-

quences. Newton's absolute rotation is then, like his absolute time and absolute space, not real but ideal, not sensibly or empirically given but intellectually conceived or constructed, not ectypal but archetypal, as Locke says of all purely mathematical ideas.

This becomes clearer, if we consider the difference between the two cases from another side. The hypothetical case is that of a finite system in an immense void; all the rest of the universe is supposed to be eliminated. In the real world we may ignore, but we cannot exclude. Thus, as already said, it is allowed that — except by accident — there is probably no body in the state described in the first law of motion, in fact, if the master generalisation of physics, the law of universal gravitation, is to be accepted, how can any particle of matter "be left to itself"? By a free particle, or a particle left to itself can only be meant a particle at an infinite distance from any other particle, and in this sense accordingly writers on abstract dynamics sometimes define the phrase. But if we could come across such a particle in actual experience, it is obvious that nothing could be said about it; spatial perception of any kind would necessarily be absent in such circumstances. In dealing with the actual world, however, the facts that meet us first are those to which Newton's second and third laws apply, and the law of inertia becomes but a special case of these. Setting out from these laws, then, instead of attempting to affirm anything concerning the movement of a particle alone in absolute space, it seems to me as a mere question of scientific taste and logic better to proceed in Mach's

fashion. Instead of saying that a particle moves without acceleration in space, Mach would say that the mean acceleration of such particle relatively to the other particles in the universe, or in a sufficient portion of the universe, is zero.[1]

As it is obviously impossible to complete the summation required to ascertain this mean exactly, such a statement has the advantage of keeping prominent the approximate character of references to the directions of certain stars as *fixed* directions. The reference to fixed terrestrial objects, which sufficed for such observations as led Galileo at first to formulate the law of inertia, is now replaced by this reference to fixed stars; but even this direction is known to change in the course of ages. Another advantage of Mach's more concrete statement, then, is that it impresses us, as he remarks, with the very complicated character of just those mechanical laws that appear the simplest. Suggested by incomplete experiences in the first instance, they lose the exactness of mathematical theory when we proceed to apply them to experience again. The manifold particulars left out of account in our abstract simplification are still there on our return to confront us anew. The insight that a pure theory has given may enable us to deal with them more effectually; it cannot justify us in ignoring their existence. Now by good fortune, not from any necessity in the constitution of things, it is found that within certain limits of exactness many of these particulars of experience are so similar, that to deal with any one appears to suffice. One result of this apparent multiplicity of

[1] But see the article by Professor MacGregor quoted above.

identicals is that, seeming to be independent of any one, we presently suppose ourselves independent of all; when to be absolutely exact we are independent of none. In applying the law of inertia to terrestrial bodies, for example, there are innumerable landmarks from which to estimate direction; if one or more become unsteady or disappear, there are still plenty of others left. So with celestial objects; if one fixed star should some day "pale its feeble light" or be found careering across the sky, there are still multitudes remaining to keep their accustomed stations. Now, it is our familiarity from time immemorial with this plenitude of possibilities that leads us to convert these several singular contingencies into a collective contingency. We then assume that, as we are independent of any one empirically marked position in space, we are independent of all. In other words, the absolute space of abstract conception is supposed to underlie the empirical space that we perceive. But now imagine, as Mach suggests, that the earth were the scene of incessant earthquakes or that the stars behaved like a swarm of flies: how should we apply the law of inertia then? Well, but to those who mean seriously to handle the universe as a mere problem in abstract dynamics we must reply that the earth *is* the scene of incessant convulsions and the fixed stars *are* like a swarm of flies. The costliness of the devices to eliminate terrestrial oscillations in certain attempts at experimental precision and the elaborate calculations to unravel the 'proper motions' of the less distant stars are plain evidence of the truth of this seemingly extravagant statement.

It would seem then that *all* bodies may be really impli-

cated in every case of movement observing the law of inertia; not *one* only, as the abstract theory assumes. What a single body would be or do if it were not for other bodies, no one can say. Unless indeed they are prepared with Stallo to say boldly, it would be nothing and therefore could do nothing. "A body," he says, "cannot survive the system of relations in which alone it has its being; its *presence* or *position* in space is no more possible without reference to other bodies than its *change of position* or *presence* is possible without such reference. . . . All properties of a body which constitute the elements of its distinguishable presence in space are in their nature relations and imply terms beyond the body itself."[1] In abstract theory, then, we may introduce first one particle and then another, each moving in given directions in absolute space; and we may talk of their speed as measured by absolute time flowing equably without relation to anything else. But, in reality, nothing of this kind is accessible to us.

It is easy to see that the mechanical theory is here divided against itself, and in this state cannot stand. Experience compels it to admit the thorough-going interdependence of all bodies, while mathematics tempts it to suppose that it is possible to deal with bodies independently and apart. The bodies which mathematics would regard as isolated wholes are but undetermined fragments of what is really indivisible, abstract aspects that never exist alone. On the one side is the ideal simplicity and completeness of a mathematical creation; on the other an illimitable complexity of relations without beginning,

[1] *Concepts and Theories of Modern Physics*, p. 200.

without middle, and without end. Now I presume nobody will blame the physicist for insisting on the relativity of all motion, the relativity of all time-measures, which practically depend on motion, or the relativity of all determinations of mass or inertia. But we have a right to demand logical consistency: if he abjure absolute terms he must abjure absolute statements. He must not confound his descriptive apparatus with the actual phenomena it is devised to describe. The apparatus consists, in general, as we have seen, of absolute time, that is, an independent variable flowing at a constant rate; of absolute motions, that is, motions referred to axes completely defined and thought of as fixed; of bodies that by definition are masses and only masses, absolutely determinate and unchangeable, and constituting together a mechanical system that is independent and complete. Of this general form of apparatus there may be several varieties, but that will be accounted the best which affords the simplest and completest description of actual movements. We cannot be sure that there is any *a priori* necessity about the particular mechanical principles of Galileo and Newton; from other fundamental definitions consequences equally exact might be deduced. As this is an assertion that to many may seem unwarranted, let me hasten to say that I do not make it without good authority; I will quote one such out of many. In an essay on the *Methods of Theoretical Physics*, Boltzmann, referring with approval to the changes introduced by Kirchhoff, thus proceeds: "Whether, with Kepler, the form of the orbit of a planet and the velocity at each point is defined, or with

Newton, the force at each point, both are really only different methods of describing the facts; and Newton's merit is only the discovery that the description of the motion of the celestial bodies is especially simple if the second differential of their coördinates in respect of time is given."[1] In either case, and in every case, then, we have only mathematical description. "The whole difficulty of philosophy," said Newton, in the Preface to his *Principia,* "seems to consist in investigating the powers of Nature by means of the phenomena of motion." Many of his successors have abandoned the enterprise. To quote Boltzmann again: "The view [has] gained ground that it cannot be the object of theory [*i.e.* of science] to penetrate the mechanism of Nature, but that, merely starting from the simplest assumptions (that certain magnitudes are linear or other elementary functions), to establish equations as elementary as possible which enable the natural phenomena to be calculated with the closest approximation." Equations, not explanations, approximation, not finality, and the simplest method the best: in such wise has the modern science of dynamics narrowed its scope. And the criterion of simplicity, it must be remembered, is in the main subjective, not objective. Our limited capacities make economy a consideration. But for such limitation, indeed, it is difficult to see why we should cumber ourselves with a descriptive apparatus of any sort. It is surely then a thoughtless prejudice to forget that the capacity to calculate and compute — though, as Laplace boasts, it renders the human species superior to the animals, and is

[1] *Philosophical Magazine*, 1893, vol. 36, p. 40.

the foundation of our glory — is also still, like apparatus generally, essentially a mark of limited powers. Regarded in this light it becomes very much a question whether the Newtonian scheme is even the simplest; indeed, other schemes, professedly simpler — and what, if true, is of greater moment, *more comprehensive* — are already in the air. If human capacities are limited, they are not stationary. As Kirchhoff remarks: "A description of certain phenomena, though it be indubitably the simplest we can now give, may in the further progress of science be superseded by another simpler still. Of such like changes the past history of mechanics furnishes instances in plenty." [1] Still this question of comparative simplicity does not concern us save as it may serve to impress two points. First, the difference between the means of description, "the conceptual shorthand," as Professor Karl Pearson happily styles it, and the perceptual realities it is devised to symbolise and summarise. Secondly, the absence of finality. A possible form of description is not enough, it must be shewn to be the only one possible, the only one that the phenomena themselves allow, before it can be held to have passed out of the region of hypothesis into that of *objective truth*.[2]

The conclusion then to which we are led is plain. *The application of abstract mechanics to real bodies is throughout hypothetical*, and absolute or unconditional mechanical statements concerning the real world are therefore unwarrantable. There are no processes in

[1] *Vorlesungen über mathematische Physik*, p. 1.

[2] Cf. Helmholtz, *Erhaltung der Kraft*, p. 7.

the real world that are certainly entirely mechanical, mechanical in the sense, I mean, of those movements of sensible masses from which Galileo and Newton inductively inferred their well-known laws. The thermal, chemical, electrical, magnetic, and other processes that as a rule not only accompany but modify such mechanical movements *may* admit of complete and simple description in purely mechanical terms. But there is no necessity that they should. Newton saw reason to hope for it, however. In the Preface to his *Principia*, he justifies its title as *Mathematical Principles of Natural Philosophy* by referring to the motions of the planets, the comets, the moon, and the sea as deduced from gravitational forces by propositions that are mathematical. He then adds, "I wish we could derive the other phenomena of nature from mechanical principles by the same kind of argument. . . . But I hope that the principles here established will afford some light either to this, or some more perfect method of philosophy." It is to this subject that we must pass in the next two lectures, and we shall then have an opportunity of inquiring which of Newton's alternative hopes is the more nearly realised: the resolution of natural phenomena that are not obviously mechanical into mechanisms, or the advent of some more perfect method embracing both. But either way our main conclusion will, I believe, still remain good.

There is one absolute statement frequently advanced by modern physicists that flagrantly transgresses the limits of a purely descriptive science, the statement, I mean, that the mass of the universe is a definite and

unchangeable quantity. Such partial and approximate evidence as experience affords in favour of such a doctrine seems to be derived ultimately from the facts of gravitation. Astronomical observations of planetary motions and chemical measurements with the balance justify the working hypothesis that such sensible masses as we know are constant within the limits of our experience and unalterable by any means in our power. Thus has been suggested the addition to abstract dynamics of a principle not explicitly formulated by Galileo or Newton, that, namely, of the Conservation of Mass, as it is technically called. If the mass-values of bodies were assumed to vary in some regular manner with the time, with the size or proximity of neighbouring systems, or the like, the procedure of abstract mechanics would be more complicated than it proves to be on the simpler hypothesis of the constancy of such mass-values. But though facts in the main conform to this hypothesis, there is no necessity about it. Still less is there any justification for converting this principle of mass-conservation into an assertion concerning the mass of the universe either in respect of its quantity or its constancy. The epistemological character of mathematical mechanics as a purely descriptive apparatus would exclude these, as well as other real affirmations, from its scope. It would be as reasonable to expect from arithmetic a census of the separate bodies in the universe as to look to pure mechanics for an assurance that the mass of the universe is, as Helmholtz would have us regard it, "an eternally unchangeable quantity." If there are any grounds for such a position at all, those

grounds must lie either in *a posteriori* inferences from experience, that can never be more than probable, or in *a priori* reasoning of a non-mathematical kind.

But before *a priori* considerations can be brought to bear on such a point, mass must be identified with matter, and matter with substance. And this is precisely what we find in the plausible and summary argument of Mr. Spencer's *First Principles*. His crucial experimental proof is just that constancy of mass, gravitationally measured, which I have already mentioned. For, after citing several trivial instances, he clenches them with the remark: "Not, however, until the rise of quantitative chemistry, could the conclusion suggested by such experiences be reduced to a certainty."[1] In spite of this very restricted evidence for the conservation of mass as a simple and useful working hypothesis, we find Mr. Spencer concluding that "the form of our thought renders it impossible for us to have experience of Matter passing into non-existence, . . . that hence the indestructibility of Matter is in strictness an *a priori* truth"; albeit the 'pseudo-thinking of undisciplined minds' is ever leading them mistakenly to suppose they can really think 'the absolutely unthinkable.' Now the question is not at all whether we can or cannot conceive the universe to arise out of, or pass into, nothing; but simply what justification there may be for a certain absolute statement concerning that dynamical phenomenon we describe by help of the conception of Mass. When Mr. Spencer or some one else shall have shewn that what exists must exist as matter or not exist at all, and that

[1] *First Principles*, § 52, stereo. ed., p. 173; rev. ed., amended, p. 154.

all matter is necessarily ponderable matter, then, but not before, the old maxim, *Ex nihilo nihil fit*, and the appeal to the balance will be relevant to the question.*

Quantity of mass is not necessarily identical with quantity of matter; and indeed, it seems obvious that, till matter is defined qualitatively, quantitive statements concerning it must be altogether precarious. Meanwhile, the prospects of a scientific definition of matter get more and more remote. The severely exact physicist of the Kirchhoff school, as we have seen, avoids the whole of this subject with disdain; while others with powerful scientific imagination like Faraday or Maxwell or Lord Kelvin, who pursue it eagerly, find themselves eluded in turn, and end, as Boltzmann says, by talking in parables.[1] Yet such parables and analogies are of inestimable value, if only as a protest against the confident dogmatism of which Mr. Spencer is such a master. Consider, for example, Lord Kelvin's well-known vortex-atom theory of ponderable matter. According to his ideal

[1] Roger Cotes begins his Preface to the *Principia* by reducing natural philosophers to three classes: first, the Aristotelians, who attribute specific and occult qualities to things, and last, the experimentalists, who invent no hypotheses, among whom, of course, he places his 'most celebrated author.' The second reject the substantial forms of the peripatetics and lay down the principle that all matter is homogeneous. "But when," he continues, "they assume to themselves a liberty of supposing at pleasure unknown figures and magnitudes, uncertain situations and motions of the parts; and moreover of supposing occult fluids, which freely pervade the pores of bodies, endowed with an all-powerful subtility, and agitated with occult motions; they then descend to visions, and neglect the true constitution of things. . . . Although they afterward proceed with the greatest accuracy from those principles [they] may be said to compose a fable, elegant, perhaps, and pleasing to the imagination, but still it is a fable."

* See Note ii, p. 588.

presentation of it we are to imagine a perfect, *i.e.* absolutely frictionless fluid; then the rotational motion of portions of this fluid are what we know as ponderable matter; while the movements of these through the fluid are what we know as moving masses. In other words, our phenomenal matter is reduced to 'non-matter in motion.' This brilliant hypothesis (which has been accounted deserving of careful and minute attention by many of our leading physicists), suffices, even as it stands, to suggest what removes there may be between our physical experiences and anything that *must* be conserved because its non-conservation is *a priori* inconceivable. But instead of taking this hypothesis as it stands, let us suppose, as the writers of the *Unseen Universe* do, that its ideal rigour is somewhat abated. Vortex rings in an *absolutely* perfect fluid would remain self-identical and undiminished forever; vortex rings in an indefinitely perfect fluid would so remain, not forever, but indefinitely long. But *per contra*, vortex rings in an indefinitely frictionless fluid could be originated through such processes as we find setting up vortices in the imperfect fluids about us; on a perfect fluid such processes would have no hold. Now, questions of theoretical simplicity and definiteness apart, there is no gainsaying the fact that there is no experimental need for assuming this ether-matter to be a perfect fluid. No balance is delicate beyond six decimal places, and our longest astronomical records are but ephemeral in comparison with cosmical ages. An 'unbroken continuity' is thus all that our experience requires, and this we have by regarding the hypothetical fluid of the vortex atoms

as indefinitely perfect; and have not, if we regard it as absolutely so.[1] Moreover, on the former alternative, we should be free to allow the possibility of ponderable matter coming to be here and ceasing to be there; the average amount in existence at once, either remaining stationary or else slowly altering, as is the case with the population of the globe, for example. Also we could entertain such a supposition without either flying in the face of any truth there is in what Mr. Spencer calls "the experimentally-established induction" that Matter is indestructible, or deserving his taunt of "not thinking at all, but merely pseudo-thinking."

This hydro-kinetic theory of matter as a mode of motion and not a substance, is specially wholesome and instructive, if we compare it with the modern theory of heat as a mode of motion, that has replaced the older theory of caloric as a substance. We cannot conceive substance to be either produced or destroyed, Mr. Spencer will tell us. True and trite, we must allow. When therefore it was found that heat and mechanical work were mutually transformable, there was an end of the theory that heat was a substance. It is now possible to produce vortex rings, to show that their behaviour in many respects approximates strikingly to the behaviour of material particles, and that this approximation would be greater if the fluids at our disposal were less unlike the continuous and frictionless fluid supposed to fill all space. Thus, though man may never be able to make or unmake a material particle, Lord Kelvin's ingenious speculations may at least pre-

[1] Cf. *Unseen Universe*, second edition, p. 118.

dispose us to believe in the thoroughly phenomenal character of all measurable masses, and, believing this, we are under no temptation to render absolute that relative constancy of such masses which our experience so far has disclosed.

How utterly unscientific it is to apply this principle of the conservation of mass to the entire universe is evident again when we reflect that it involves the further assertion that the universe is a finite system. Some recent writers on arithmetic talk of numbers that are at once infinite and complete, transfinite numbers as they are called. But it is obvious that there can be no scientific warrant for affirming such definite infinity of the universe, and there is certainly no empirical justification for affirming definite limits. No doubt what we see is limited; but to contend that we see no more, simply because there is no more to see, would be more illogical than it is to maintain that the bulk that may be beyond us *must* resemble the sample that we know. What we see is limited indeed in the sense of being finite, but it is not limited in the sense of being either constant or complete.

But now if the physicist were to ask the mathematician to devise for him a descriptive apparatus adapted to the movements of a material system in which the mass-values varied, the mathematician's first question would be: How do they vary? The physicist could not say. Innumerable forms of regular increase or decrease or of periodic alternation of the two are possible. Over against this bewildering variety the one definite supposition of constancy, in itself the simplest,

is borne out by the very small fraction of the world that we can imperfectly measure. This seems to me how the case stands; and if it is, then it becomes plain that abstract dynamics affords as little ground for absolute statements about the magnitude or constancy of mass as for such statements concerning space or time. There are writers, however, who do not hesitate to rest this doctrine of the conservation of mass on that of the conservation of energy. But as this only means that in their opinion the latter doctrine cannot be true if the mass of the universe is not constant, such a plea is worthless unless there are independent reasons for maintaining that the energy of the universe is constant; and would not necessarily be true even then. The discussion of this important subject it will be best to defer till we have dealt with the application of abstract dynamics to the phenomena of molecular physics. To this I will ask your attention in the next lecture.

LECTURE IV

MOLECULAR MECHANICS: ITS INDIRECTNESS

Distinction of mass and molecule. The molecule not a 'minute body.'

The advance from abstract mechanics to molecular physics: Mechanics historically a usurper.

Molecular mechanics is (a) *indirect and* (b) *ideal.*

(a *i.*) *The evidence for* molecules *examined. Clerk Maxwell's theory of 'manufactured articles.' Clifford's criticisms. Further criticisms. Maxwell's theistic bias. The status of the molecule hypothetical. Statistical physics commented upon.*

(a *ii.*) *Evolution applied to the molecule. The mechanical theory bound, if possible, to resolve it into something simpler: the prime-atom.*

(a *iii.*) *The* ether — *one or more. Lord Kelvin sure of it, but chiefly because the mechanical theory cannot get on otherwise. New ethers invented to meet new mechanical problems. Signs of a reaction. Professors Drude and K. Pearson quoted. Hypothetical mechanisms and illustrative mechanisms distinct, but apt to get confused. Masterful analogies dangerous: is nothing intelligible but what is mechanical?*

THERE is no obvious similarity between the swinging of a pendulum or the motion of colliding billiard balls and the light and warmth of a glowing coal or of the sun. Still, as we have seen, Newton entertained the hope that both kinds of process might be described by means of the same mechanical principles. This hope we find has become an axiom for modern science; and the special conceptions involved and the peculiar methods employed

in thus applying mechanical principles to molecular physics are what we must endeavour to examine to-day.

The distinction of mole and molecule, of large mass and small mass, is clearly not in itself a distinction of kind. It is due in the first instance to a psychological fact entirely external and irrelevant to the pure science of mechanics, to the fact, I mean, that we cannot perceive bodies of less than a certain size, changes of position of less than a certain extent, intervals of time of less than a certain duration, and so on. Still, however irrelevant to the mathematician, the fact of such *minima sensibilia* necessarily entails important differences of method upon the physicist, when he essays to apply mechanical principles to systems whose parts and motions are no longer directly discernible. The use of artificial means of magnification convinces us of what was already *a priori* probable, viz.: that the limits imposed by our senses are merely accidental limits without any objective significance. Consider in this connexion two statements that we often hear: the one that a given mole or molecule is divisible without limit into ever smaller particles; the other that such given mass or molecule consists of a finite number of absolutely indiscerptible particles called ultimate atoms. It is the latter far more than the former of these propositions that is logically open to suspicion. For the latter is an absolute statement, and since it is an absolute statement that cannot claim to be a necessity of thought, it is one that seems clearly incapable of proof. But to propositions of the former type, propositions, that is to say, asserting or implying the existence of bodies of indefinitely small dimensions

and perhaps of indefinitely great complexity, we can have at any rate no *a priori* objection.

The molecules of modern physics and the so-called chemical atoms, however, are not bodies in this sense, and it is difficult to imagine that much would be gained by the assumption of their existence, if they were. This may sound paradoxical; I will try to explain. There is a passage in Laplace's *Exposition du système du monde*, one that has excited some discussion recently, which will serve admirably to illustrate what I mean, for it supposes an extreme case. Referring to the law of actions varying inversely as the square of the distance, as the law that holds for all forces and emanations that set out from a centre, he remarks: "Thus this law, answering exactly to all the phenomena, is to be regarded, both on account of its simplicity and its generality, as a rigorous law. One of its remarkable properties is that if the dimensions of all the bodies of the universe, their mutual distances and their velocities, were to increase or diminish proportionally, they would describe curves entirely similar to those they describe now; so that the universe thus continuously reduced down to the smallest space imaginable would present always the same appearances to observers."[1] If then we can have the universe on any scale, we might—if it is finite, as Laplace inclined to think it—have it complete within the head of a pin; and ought therefore to feel no surprise at physicists who, on the one hand, compare 'a compound atom,' as Jevons does, to a stellar system, each star a minor system in itself; "or who, on the other, talk of

[1] *o.c.*, bk. v, chap. v *fin.*, *Œuvres complètes*, 1893, vol. vi, p. 471.

Jupiter and his satellites as a planetary molecule."[1] But if a molecule were a constellation on a vastly smaller scale, then the phenomena of light, heat, magnetism, and the like, to explain which the molecular constitution of bodies has been assumed, would reappear in the molecule, and again in the molecule of the molecule, and so on indefinitely. On such lines then no logical advance could be made. There may be molecules or atoms of many orders, but, effectively to replace physical properties by mechanical processes, the molecule of any order must be divested of whatever property its motions are to explain or describe. Thus the molecules whose motions on the kinetic theory of heat answer to that state of a body which we call its temperature are not themselves credited with heat. Again, magnetism is not explained by resolving the smallest steel particles in a magnet severally into magnets, but by an imponderable fluid circulating round the particle, and so on.

Let us now attempt to characterise in a general way the application of abstract mechanics to molecular physics. We start with bodies of sensible dimensions. The dynamical transactions between such bodies can be directly observed and described, such description requiring no conceptions beyond those of mass, force, space, and time, except of course, number, which measurement involves. In confining itself to these conceptions, molar physics employs methods that are invariably abstract. Those important qualities possessed by every body in its own specific fashion, the differences of which remain for our perception as unique and irresolvable as are the sensations of

[1] Cf. Stallo, *Concepts of Modern Physics*, p. 122.

our several senses,—all these it simply ignores. They receive their proximate scientific handling in the various branches of experimental physics or of chemistry. Here numerous empirical laws are ascertained that do not in general overstep the qualitative barriers just mentioned. These comparatively restricted generalisations, obtained from experiments on light, heat, electricity, chemical composition and decomposition, and the like, are the material to which the theoretical physicist applies his mechanical scheme of molecules, molecular motions, and molecular forces. No doubt by this time the mathematical physicist himself undertakes or initiates experiments for the purpose of verifying or advancing his molecular constructions. But this in no way affects the fact that molecular physics can never come to such close quarters * with its molecules as molar physics can with the sensible masses and motions, from which the principles of the mechanical theory were first of all deduced.

To put the case in another way. Molar physics or mechanics was historically but one branch of general physics coördinate with those other experimental branches called Optics, Acoustics, Thermotics, etc. So matters stood in Newton's time, when he completed the main outlines of that mathematical edifice, now known as abstract dynamics, or, as he called it, 'rational mechanics.' Molecular physics is then, historically regarded, nothing but the endeavour to include the less perfect branches of physics within the domain of the most perfect—an endeavour that Newton himself, as we have seen, fully approved. The discovery that the stresses

* See Note iii, p. 588.

between electrified or magnetised bodies also varied inversely as the square of the distance between them, as do the stresses between gravitating masses, led to a wider use of the conception of centres of attraction or repulsion. Thus the mechanism which Newton found exemplified in the case of the heavenly bodies came to be regarded as a sort of type or paradigm. It would apply, as we have seen Laplace pointing out, on any scale, however great or small. So we come by the general hypothesis of molecular physics: that all physical phenomena—however complete, however ultimate, however numerous, their qualitative diversities may be, and remain, for our perception—can still be shewn to correspond to, and to be summed up by, purely dynamical equations, such equations describing the configurations and motions of a system of masses called molecules from their minuteness (according to the *Homo Mensura* standard). In other words, the hypothesis of molecular physics is that all the qualitative variety of the external world can be resolved into quantitative relations of time, space, and mass, that is of mass and motion.

This general characterisation of molecular physics we may now resume under two heads, each of which it will repay us to discuss somewhat further. First of all, the descriptions of molar physics may be called direct, whereas those of molecular physics are always indirect, the indirectness being often, if I may say so, of many removes from directness. Secondly, the descriptions of molar physics are abstract: *one* property of bodies, that of massiveness, of which we can have sensible evidence, is taken; the *remaining* properties are simply left out.

of account. But the descriptions of molecular physics taken together are not in this sense abstract. They leave no properties out of account; on the contrary, they transform everything qualitative into quantitative equivalents. It was to this point that I referred at the outset of this discussion (in the second lecture) in calling the methods of molecular physics ideal.[1] I should be glad of some less ambiguous term, but can only hope that at the end of our discussion its meaning may be clearer.

To begin with the indirectnesses. Nobody has ever seen or felt, and if the physicists are to be trusted, no instruments of magnification are possible by which in the future any one can be helped to see or feel, an individual molecule. This, of course, would be a matter of no importance if the molecule were merely regarded as one particle of some homogeneous mass of sensible volume. But the atoms and molecules of modern science, if they have any real existence at all, are distinct individuals; at all events, they have more title to be so described than either the earth or the sun, which we commonly regard as individual objects. For the earth or sun are after all but aggregate masses, constantly receiving additions — as in the meteoric showers that feed the sun; and probably — in the case of the earth and many smaller bodies, at least — constantly scattering part of their mass into space, as the moon, for example, is supposed to have diffused away its free gases and vapours. Not so the atoms and molecules of the chemist. The progress of stellar spectroscopy and

[1] Cf. above, p. 51.

of chemical physics, we are told, shuts us up to the view that the whole universe apart from the ether or ethers — of which more presently — consists entirely of varying arrangements of incalculable numbers of some seventy different elements, the individuals of each kind being absolutely identical in their properties, and all alike entirely beyond the reach of change or decay. Philosophic speculations of this sort are, of course, no novelty; but when we are asked to accept such statements as scientific truth and verity on evidence that *can* only be indirect, we may well be pardoned by 'those who know' if we look a little critically, even sceptically, at that evidence. But you may wish first of all to have the statement itself in some accredited form. Let me then quote two or three sentences from the *Collected Papers* of Clerk Maxwell (vol. ii, pp. 361 ff.): — "The same kind of molecule, say that of hydrogen, has the same set of periods of vibration, whether we procure the hydrogen from water, from coal, or from meteoric iron. . . . Whether in Sirius or in Arcturus [it] executes its vibrations in precisely the same time." "Though in the course of ages catastrophes have occurred, and may yet occur, in the heavens, though ancient systems may be dissolved and new systems evolved out of their ruins; the molecules out of which these systems are built — the foundation stones of the material universe — remain unbroken and unworn." Elsewhere Maxwell proceeds to make inferences concerning the supernatural from this position. "None of the processes of Nature," he says, "since the time when Nature began, have produced the slightest difference in the properties of any

molecule. We are therefore unable to ascribe either the existence of the molecules or the identity of their properties to the operation of any of the causes which we call natural. On the other hand, the exact equality of each molecule to all others of the same kind gives it, as Sir John Herschel has well said, the essential character of a manufactured article, and precludes the idea of its being eternal and self-existent." This argument would be open to question even if it were certain that the molecules of any given element are *exactly alike.* To many it would seem more reasonable in such case to side with Democritus and regard what within the whole range of actual or possible experience is absolutely permanent and without the shadow of a change as realising all that we can understand by 'self-subsistent and eternal.' Moreover, the disparity between the conception of creation and the conception of manufactured goods is so complete as to make all attempts at analogy futile.

But to return to our immediate question: Of what nature is the evidence, on which molecules of hydrogen, oxygen, or any supposed element are pronounced to be respectively, each to each, exactly alike, the same through all vicissitudes and everlasting as time itself. As to the exact likeness—let me once more remark that it is impossible to deal directly with the individual molecules; and, even if it were, no measurements and no physical comparisons are exact. But the measurements of molecules, besides being indirect, are all made in bulk. What is really measured is the combined effect of millions, or it may be billions, of molecules.

So that, even supposing disturbing causes to be entirely excluded, the resulting measurement is true only of the average molecule and leaves the range of the individual deviations at best but partially determined. The most delicate test so far available, that of the spectroscope, seems always to be beset by at least one disturbing factor. On this method the qualitative identity of the molecules of a given element in the gaseous state is inferred from their light-note. But every one who has heard the sound-note of the whistle of a train in motion must have observed that this note sounds higher so long as the train is approaching, and lower as soon as it has passed and begun to recede. To get the light-note true, the molecules should be observed free from their translatory motions towards and away from the observer. The variations thus produced can only be set down entirely to the account of the translatory motions after independent proof has been adduced of the absolute likeness of the molecules. Meanwhile it has to be shared between the two. But since Maxwell wrote the passages I have quoted, it has been shewn that the spectra of several elements vary with the temperature and the pressure to which the gas is exposed; and when a gas approaches the liquid condition these changes appear to be greater still. What various degrees of aggregation there may be in the liquid or solid state, and how far the individuality of the molecule disappears in such aggregation — these are problems for which there appears at present no definite solution.[1]

Graham's familiar method of dialysis, or atom-sifting,

[1] Cf. Ostwald, *Outlines*, pp. 189, f.

is also appealed to by Maxwell to establish the perfect identity of the molecules of the same kind of matter. Graham found, it will be remembered, that light gases pass through a porous septum more rapidly than heavier ones. Maxwell is referring to this method when at the close of his book on *Heat* he says: "If of the molecules of some substance such as hydrogen, some were of sensibly greater mass than others . . . in this way we should be able to produce two kinds of hydrogen, one of which would be somewhat denser than the other. As this cannot be done, we must admit that the equality which we assert to exist between the molecules of hydrogen applies to each individual molecule, and not merely to the average of groups of millions of molecules."[1] But there is a world of difference between saying of a million molecules that the mass of no one of them is '*sensibly greater*' than that of the rest, and saying that the masses of all are absolutely equal.

I cannot help thinking that Clifford reasons far more soundly than Maxwell in dealing with this same method of dialysis. "If we put any single gas into a vessel," he says, "and we filter it through a septum of black-lead into another vessel, we find no difference between the gas on one side of the wall and the gas on the other side. That is to say, if there is any difference, it is too small to be perceived by our present means of observation. It is upon that sort of evidence that the statement rests that the molecules of a given gas are all very nearly of the same weight. Why do I say *very nearly?* Because evidence of that sort can never prove

[1] *Heat*, p. 339.

that they are exactly of the same weight. The means of measurement we have may be exceedingly correct, but a certain limit must always be allowed for deviation; and if the deviations of molecules of oxygen from a certain standard of weight were very small, and restricted within certain limits, it would be quite possible for our experiments to give us the results which they do now. Suppose, for example, the variation in the size of the oxygen atoms were as great as that in the weight of different men, then it would be very difficult indeed to tell by such a process of sifting what that difference was, or, in fact, to establish that it existed at all. But, on the other hand, if we suppose the forces which originally caused all those molecules to be so nearly alike as they are to be constantly acting and setting the thing right as soon as by any sort of experiment we set it wrong, then the small oxygen atoms on one side would be made up to their right size and it would be impossible to test the difference by any experiment which was not quicker than the process by which they were made right again."[1] * Had Clifford been writing now he might have illustrated this last point by a reference to Mr. Galton's principle of reversion towards the mean, in accordance with which the children of giants, for example, tend to be of less stature, and the children of dwarfs to be of greater stature, than their parents.[2]

[1] *Lectures and Essays*, vol. i, p. 207. * See Note iv, p. 588.

[2] It is well known that some chemists agree with Sir William Crookes in thinking that "probably our atomic weights merely represent a mean value around which the actual atomic weights of these atoms vary within certain narrow limits," reminding us of Newton's 'old worn particles,'

But Maxwell felt himself "debarred from imagining any cause of equalisation on account of the immutability of each individual molecule"—this being the second article of his molecular creed, as that of exact likeness was the first. There is, I fear, something circular in Maxwell's arguments for these two positions. On the one hand the ingenerability and immutability seem to be used in proof of the qualitative and quantitative identity; although, on the other, this very identity had served as an argument for that everlasting constancy which in turn it now helps to prove. Nay, his argument seems even weaker than that, for he takes for granted that the persistence which he asserts for his normal molecules would belong also to abnormal ones, if any such there were. And so, assuming the exact equality of all the individual molecules of hydrogen, etc., within the range of our experience, he asks where can the eliminated molecules have gone to? He then proceeds: "The time required to eliminate from the whole of the visible universe every molecule whose mass differs from that of some of our so-called elements, by processes similar to Graham's method of dialysis, which is the only method we can conceive of at present, would exceed the utmost limits ever demanded by evolutionists as many times as these exceed the period of vibration of a molecule." But surely it is quite gratuitous

save that the result is not supposed to be due to wear and tear. Besides referring to Sir William Crookes's researches into the fractionation of yttrium—one more instance, and a splendid one, of the saying that genius is patience—I may mention the experiments on the homogeneity of helium just published by Messrs. Ramsay and Collie. See *Nature*, 1896, vol. liv, p. 408.

to assume that they could only disappear by being sifted out on some chaotic dust-heap beyond the fixed stars, a sort of limbo for manufactured articles spoilt in the making.

And this remark suggests a more searching question: What, precisely, is it of which this immutable individuality is affirmed? Is it of a form or is it of a substance? * The biologist can tell us of species that have persisted unchanged from times so long anterior to ours that the hoariest mountain ranges appear by comparison to have sprung up but yesterday. But here it is only the *form* that endures, the particular individuals being quite transitory. A lake dries up and its tiny inhabitants perish; after a longer or shorter interval the water returns and the old living forms reappear. But the biologist does not follow the analogy of the chemist, and pronounce these to be necessarily the earlier individuals emerging from some quasi-chemical condition in which their characteristic properties have been suspended or masked. Now physical astronomers find that the spectra of certain of the whiter, and presumably hotter, stars yield indications of no element save hydrogen; also that as stars approximate to a red colour, and so have presumably a lower temperature, they furnish more varied and complex spectra, indicating the presence of many other elements besides hydrogen. The simplest supposition we can make — and it is one actually made — is that in the earlier stages of stellar evolution, of which we thus get peeps, the various chemical elements come successively into being, as do various forms of vegetable and animal life in the later stages of the

* See Note v, p. 588.

same vast process.[1] But what becomes of the molecule as an article manufactured before natural processes began? The best that can be said is, not that the individual article is a fabric of timeless origin, but only that its form or pattern is thus (relatively) immutable and ingenerable. It is still possible, however, to reinstate some persisting individual by falling back on primal atoms or elements of a higher order. And phenomena daily observed by the chemist at once suggest this step. As ordinary chemical compounds can be decomposed at high temperatures, it is probable that our so-called elements may be 'split up' into elements of a new order by temperatures greatly in excess of any that we can command. Those who think fit may regard this higher order of element as furnishing "the foundation stones of the material universe" and remaining—though the firmament be dissolved and renewed again—"in the precise condition in which they first began to exist." But such an opinion can no longer be entertained of the molecules 'built up' of these stones,—molecules that processes now going on seem to make and unmake, as the chemist makes further compounds out of them, which he can afterwards decompose again. Maxwell was evidently prepared for this alternative. In the closing paragraph of his *Theory of Heat*, he asks, "But if we suppose the molecules to be made at all, *or if we suppose them to consist of some thing previously made*, why should we expect any irregularity to exist among them?"

But surely it is far from indifferent which of these

[1] Cf. Sir W. Crookes's brilliant Address to the Chemical Section of the Brit. Assoc., 1886, *Nature*, vol. xxxiv, pp. 423 ff. * See Note vi, p. 589.

alternatives we adopt when inquiring what amount of "irregularity" we may expect among the molecules of any given chemical stuff. If the molecules of oxygen, hydrogen, etc., are themselves primeval and immutable individuals, they are like nothing else that we know, and we can have no scientific grounds for *expecting* anything about them one way or other. But if they are compounds that are put together and again 'split up' in the course of nature, then, in the absence of certain knowledge to the contrary, we *may* expect among their forms any of the regularities or irregularities that we find elsewhere among dissoluble products. In particular we might expect, for example, that certain of these forms, like some of the chemical compounds that we know as such, would prove very unstable, and so disappear almost as soon as they arose; others again, like certain refractory minerals long regarded as elements, might persist indefinitely. The striking analogy between the grouping of chemical elements, when ranged as in the periodic laws of Meyer and Mendelejeff, and the grouping of biological forms, might tempt us to entertain the hypothesis, *mutatis mutandis*, of some sort of chemical evolution. But absolute qualitative identity, for which Herschel and Maxwell contended, would be almost as incompatible with such an hypothesis as absolute immutability. Both these absolute ideas would be alien to the notion of continuous transmutability or of connecting forms.

Digressing for a moment, let me remark that both these ideas, there can be little doubt, are far more due to theological zeal than to the bare logic of the facts. In the fine conclusion of his text-book on *Heat*, after

asking, "Why should we expect any irregularity to exist among them,"—the molecules, *i.e.* of the same kind of matter,—Maxwell continues: "Why should we not rather look for some indication of that spirit of order, our scientific confidence in which is never shaken . . . and of which our moral estimation is shown in all our attempts to think and speak the truth, and to ascertain the exact principles of distributive justice?"[1] But why so confidently assume, we might reply, that a rigid and monotonous uniformity is the only, or the highest, indication of the spirit of order, the order of an ever-living Spirit above all? How is it then that we depreciate machine-made articles and prefer those in which the artistic impulse or the fitness of the individual case is free to shape and to control what is literally manufactured, hand-made? The work of an engine-fitter is greatly facilitated by the use of Whitworth bolts, tubing of regulation sizes, and the like, but surely it is trivial to frame teleological arguments concerning the universe from the standpoint of a millwright. So the existence of a limited number of absolute constants in nature might bring the universe within the compass of the Laplacean calculator. But, dangerous as teleological arguments in general may be, we may at least safely say the world was not designed to make science easy. Struggling men and women, like the soldier on the march when his machine-made shoe pinches, might reasonably complain if science should succeed in persuading them that Nature's doles and Nature's dealings from first to last are ruthlessly and rigidly mechanical. To

[1] *Heat*, p. 342.

call the verses of a poet, the politics of a statesman, or the awards of a judge *mechanical*, implies, as Lotze has pointed out, marked disparagement: although it implies, too, precisely those characteristics — exactness and invariability — in which Maxwell would have us see a token of the Divine.

But, returning to our facts and avoiding altogether any question as to why we should expect this or why we should expect that, for such questions lie beyond the legitimate pale of science, let us gather up what we find. Chemical molecules are not presented realities: in other words, a molecule — say of oxygen — is not a small body which is known to exist as an individual of a definite species, distinct, say, from a molecule of nitrogen, an individual of another definite species of small body. Individual chemical molecules are not known, as rubies or palms are known, *i.e.* as instances of species and distinct from diamonds or cedars, instances of other species. The chemical molecule is a hypothetical conception. Such things *may* exist or the hypothesis would not be legitimate. Whether they actually exist or not, they, at any rate, serve, like certain legal and commercial fictions, to facilitate the business of scientific description. If they exist, then facts show that the molecules of a given species are very nearly alike; the said facts admitting of interpretation according to statistical methods. As in other cases admitting of statistical treatment, so here the physicist is free to regard all molecules of a class as exactly like his mean or average molecule. But he is not entitled to let this abstract simplification harden into concrete fact. Perhaps it may be thought that such

rigorism is pedantic. So far as any particular physical inquiry is concerned it may be, but I am very doubtful even of this. At all events, if such unwarrantable concreting of abstracts is to lead logically to a mechanical theory of the universe, we do well to take note of it.

To make the bearing of this remark clearer, let us turn our attention for a moment to the very parallel case of economic theory and the interpretation of industrial and social statistics. The science of so-called pure or deductive economics has much in common with physics, that is to say, it sets out from definitions and axioms and seeks to describe economic facts by means of mathematical equations. The 'economic man' as conceived by Ricardo, a 'market' as defined by Cournot, James Mill's 'doses of capital,' the 'margin of cultivation,' or Jevons's 'supply and demand curves,' are not things we expect to meet with in real life. They are abstractions that summarise experience, not concrete realities directly experienced. Englishmen about to marry are not observed to be exclusively interested in women their juniors by 2.05 years, though according to the tables this is the difference of age between the Englishman and his wife. But, again, the Englishman or the Frenchman, or the civilised man or the savage, is a concept, not a reality. Yet a science of anthropology is possible in which different races of men and different stages of human development are compared by the help of mean values obtained by dealing with nations and societies *en bloc*. And perhaps "in this way," as Lotze has said, "we may easily imagine how all kinds of formulæ may be arrived at, expressive of the accel-

eration and breadth and depth and colouring of the current of historical progress, formulæ which, if applied to particulars, would be found to be utterly inexact, but which can yet claim to express the true law of history as freed from disturbing individual influences."[1] It was precisely this misapplication to particulars that led Buckle to say that in a given state of society a certain number of persons *must* put an end to their own lives. Now, if, when both the varying particulars and the statistical constants are alike well known, it is possible for a reasonable man to fall into the error of converting the one into an iron necessity which rules over the other, no wonder this should be the prevalent attitude in departments of knowledge where particulars are beyond our ken. I contend then that the most the physicist is entitled to assert is, that, if there are molecules, the mass of the mean oxygen 'atom' is sixteen, that of the mean hydrogen 'atom' being taken as unity; and so on for the rest of his table of masses. He is not entitled to say that if there are molecules the mass of every oxygen atom is precisely sixteen times the mass of any hydrogen atom. Try to picture to yourselves the sort of science of man and of society that would be formulated by an intelligence whose data were confined to anthropometrical and other statistical results and who treated his data in the customary physical fashion. You will conclude, I think, that his human beings or *homunculi* would come out surprisingly like Herschel's molecules as 'manufactured articles,' and that his theory of society would have more than a superficial resemblance to the kinetic theory of gases.

[1] *Microcosmus*, e.t. ii, p. 195.

Finally, as the facts do not justify the assertion of exact likeness among molecules, neither do they afford ground for the assertion that individual molecules are immutable and incorruptible. Once this is clear, then molecules, if there are such things, come within the range of the great conception of evolution; and facts pointing in this direction are known already and are steadily accumulating. As Huxley well says: "The idea that atoms are absolutely ingenerable and immutable 'manufactured articles' stands on the same sort of foundation as the idea that biological species are 'manufactured articles' stood thirty years ago; and the supposed constancy of the elementary atoms, during the enormous lapse of time measured by the existence of our universe, is of no more weight against the possibility of change in them . . . than the constancy of species in Egypt since the days of Rameses or of Cheops is evidence of their immutability during all past epochs of the earth's history. It seems safe to prophesy that the hypothesis of the evolution of the elements from a primitive matter will, in future, play no less a part in the history of science than the atomic hypothesis, which, to begin with, had no greater, if so great, an empirical foundation."[1] * We may, I think, go even farther. Somehow or other the qualitative diversity of the chemical elements must admit of description by means of quantitative relations of mass-points, configurations, and movements—*if the mechanical theory is to make good its claims.* Indeed,

[1] *Collected Essays*, vol. i, pp. 79 f. * See Note vii, p. 589.

the unceasing efforts of chemists and physicists in this direction can be regarded as an emphatic admission that they have laid this charge upon themselves. Moreover, in what is called the New Chemistry or General Chemistry — take Ostwald's well-known *Outlines* as an example — we see how much they have already accomplished; and also, I will add, how very much more still remains to be done.

But let us turn now to another order of facts. If the molecules concerned in chemical reactions and in the kinetic theory of gases are beyond sensible reach, the forms of matter immediately concerned in the phenomena of radiation, electricity, and magnetism are more remote still. It is in connexion with these that the ether or ethers come upon the scene. I say ethers because it is by no means certain that one will suffice. "It is only when we remember," says Maxwell, "the extensive and mischievous influence on science which hypotheses about ethers used formerly to exercise, that we can appreciate the horror of ethers which sober-minded men had during the eighteenth century, and which, probably as a sort of hereditary prejudice, descended even to the late J. S. Mill." Time seems to have brought its revenge, for nowadays the ether is regarded as preëminently real. Thus, in a lecture given about ten years ago and recently published, our foremost physicist said to his hearers: "You can imagine particles of something, the thing whose motion constitutes light. This thing we call the luminiferous ether. *That is the only substance we are confident of in dynamics.* One thing we are sure of, and that is *the*

reality and substantiality of the luminiferous ether."[1] Yet in spite of this confidence of Lord Kelvin's I cannot help thinking that a jury of logicians would side with Mill. But possibly some of you may be disposed to ask, What has the question as to the real or hypothetical nature of the luminiferous ether to do with the mechanical theory of the universe? Simply that unless a material medium for its propagation is either found or assumed, the phenomena of light cannot be mechanically described. And the remark applies equally to other forms of radiation as well as to electricity and magnetism. If themselves without mass, these phenomena must depend on the configuration or motions of something that is massive, or it is obviously impossible to describe them in the mechanical terms at present in vogue. That need entail no detriment to the special physical sciences concerned with their description and measurement by means of a more concrete and qualitative terminology; and, indeed, some able physicists prefer to leave the question of a medium entirely aside.[2] But to do this so far puts a stop to the resolution of all physical changes into mechanical processes. We shall all perhaps allow a reasonable presumption in favour of any theory that will unify the variety of physical facts. But then some of us feel that physicists have too hastily assumed that, unless these facts have a common mechanical foundation, they can have no intelligible connexion at all. Even if the mechanical theory prove to be in fact the best, there is no *a priori* neces-

[1] Lord Kelvin, *Popular Lectures and Addresses*, vol. i, p. 310.

[2] F. E. Neumann, for example. Cf. Volkmann, *Theorie des Lichts*, p. 4.

sity about it. Yet covertly or overtly some such necessity is assumed; and it is mainly on the basis of this postulate that the ether is raised from the subsidiary position of a descriptive hypothesis to the rank of a thing having "reality and substantiality." Grant, first, that the world must be intelligible; shew, secondly, that to be intelligible it must be mechanical; and then shew that to be mechanical there must be an ether or ethers whose motions constitute light, electro-magnetism, etc., grant all this and then—spite of the absence of direct evidence—we might say the existence of ether is indirectly proved. But the first two steps in this argument, it will be observed, are philosophical and the second very disputable philosophy. Science, however, has no right to build on philosophical premisses, and is forward, as we have seen, to disown, with much needless blasphemy, all such *a priori* methods. Leave aside then any presuppositions of this kind, and the ether remains but a mechanical hypothesis; its perceptual reality, if proved at all, can only be proved by some crucial experiment or by cumulative experimental evidence. No doubt its value as a descriptive hypothesis has been greatly enhanced since Mill's time—notably by the labours of Maxwell and Hertz. But as to the worth of their results I suppose Poincaré's remark upon it is not too cautious: "There still remains much to be done; the identity of light and electricity is from to-day something more than a seducing hypothesis; it is a probable truth, but it is not yet a proved truth." [1]

[1] *Nature*, 1894, vol. l, p. 11.

But though the conception of an all-pervading ether has gained in scientific importance since Mill's controversy with Whewell, it has also been repeatedly modified, I might even say transformed. At one time or other it has been regarded as a gas, as an elastic solid of small density but high rigidity, as a 'quasi-solid' constituted by turbulent motion in an incompressible inviscid fluid — with two or three sub-varieties of this hydrokinetic type. And when a new ether is invented the problem is to ascertain how many of the special laws of radiation or electricity can be mechanically deduced from it. In no case has this demand been adequately met; hence the attempts, continually renewed, to devise more satisfactory ethers. Surely if the ether were a *definite* thing, the reality of which was an established fact, it would be impossible to take these liberties with it. On the other hand, is it not certain that if, conceivably, some non-mechanical hypothesis were to afford a simpler and more complete unification of optical and electrical phenomena, there would be an end of luminiferous and electric ethers, just as there was an end of phlogiston in the days of Priestley and Lavoisier, and as there has been an end of caloric and electrical fluids in our own? By a non-mechanical hypothesis, I mean here one in which some or all of the Newtonian laws are denied or modified.[1] I should hardly have ventured even to suggest such a thing on my own responsibility. But I observe that several physicists in the present unsettled state of the science are prepared to entertain such heresies. I

[1] Perhaps such a restriction is in itself unwarranted, but it serves my purpose here.

will quote two. Professor Drude, on succeeding to a new chair at Leipzig, devoted his inaugural lecture to the *Theory of Physics*. Referring to the characteristic difference between what we call matter and what we call ether, viz.: that the former consists of smallest inhomogeneities, — a finely grained structure, as we say in English, — while the latter is thoroughly homogeneous, he continues: "The physics of matter must then appear the more complicated compared with the physics of the ether. Is not that an indication that no simplification can result if we attempt to describe the physics of the ether formally in the same manner as the physics of matter, that is to say, by means of mechanical equations?"[1] Again, Professor Karl Pearson, in his *Grammar of Science*, referring to the Newtonian laws, asks: "Ought we to assert that these laws hold in their entirety for all the scale from particle to ether-element? Or will it be more advantageous to postulate that mechanism in whole or part flows from the ascending complexity of our structure, that the ether-element is largely the source of mechanism, but is not completely mechanical in the sense of obeying the laws of motion as given in dynamical text-books?" And in another passage: "The object of science is to describe in the fewest words the widest range of phenomena, and it is quite possible that a conception of the ether may one day be formed in which the mechanism of gross 'matter' itself may, to a great extent, be resumed. Indeed, it is on these points of the constitution of the ether, and the structure of the prime atom, that physical theory is at present chiefly at fault.

[1] *Die Theorie in der Physik*, 1895, p. 13.

8

There is plenty of opportunity for careful experiments to define more narrowly the perceptual facts we want to describe scientifically; but there is still more need for a brilliant use of the scientific imagination. There are greater conceptions yet to be formed than the law of gravitation or the evolution of species by natural selection. It is not problems that are wanting, but the inspiration to solve them; and those who shall unravel them will stand the compeers of Newton and Darwin."[1]

The remarks and queries just quoted apply to the electric and luminiferous medium or media, though the medium the writers have also in view is doubtless what has been called "the primordial medium"; such, *e.g.*, as the perfect fluid of Lord Kelvin's vortex-atoms, from which ultimate ether the proximate ether of light and electricity is supposed to be formed. At this primordial and absolutely homogeneous fluid the physical theorist is content at last to stop; and for this at present no confident claim is advanced to "reality and substantiality." Will the physicists of fifty years hence remain as modest—should this hypothesis, as seems likely, hold its ground so long?

So much then must serve to illustrate what I called the indirectness of molecular physics. Under this head we have noted a tendency to treat statistical means and hypothetical mechanism as concrete realities. And here it seems needful to make a distinction or we may be charged with unfairness—a distinction, I mean, between hypothetical mechanisms and illustrative mechanisms employed solely for expository purposes. To the latter

[1] *Grammar of Science*, 2nd ed., pp. 284, 312.

class, for example, belong unquestionably the "idle wheels" of Maxwell's electro-magnetic theory and again Lord Kelvin's gyrostatic cells. On the other hand his quasi-elastic ether, or his quasi-labile ether, seem to be meant as real and not as merely illustrative analogies. But it is to be feared that physicists of the school of Maxwell and Lord Kelvin, who — to use Boltzmann's description of them — "are particularly fond of the variegated garment of mechanical representation," are apt unconsciously to play fast and loose with the difference between fiction and fact, when elaborating their mechanical models. Analogy, as we know, is a good servant, but a bad master; for, when master, it does more to blind than it may previously have done to illuminate. Most of us, I suppose, have chanced to observe a bee buzzing up and down within the four sides of a window-pane, vainly endeavouring to escape by the only obvious way — the way most light comes; whereas by merely traversing the dark border of the window-frame it might at once reach the open casement. The history of science is full of instances of able men similarly thwarted by a too-prepossessing analogy. In his lectures at the Johns Hopkins University Lord Kelvin is reported to have said, "I never satisfy myself till I can make a mechanical model of a thing. If I can make a mechanical model I can understand it. As long as I cannot make *a mechanical model all the way through*, I cannot understand, and that is why I cannot get the electro-magnetic theory of light."[1] Now I should like respectfully to ask whether

[1] *Nature*, vol. xxxi, p. 603.

this is not possibly a case of unwarrantable submission to analogies. As before, I ask again: Why must mechanism "*all the way through*" be the one and only means of intelligibility? When we recollect the comparatively small range of the experiences within which mechanical laws are found to be verifiable abstractions, are we bound to assume that they are the only concrete realities at the very foundations of physical things? This question brings us to the second characteristic of molecular mechanics just now referred to — its ideal of matter. The consideration of this may perhaps give us further light, but must be deferred till the next lecture.

LECTURE V

MOLECULAR MECHANICS: IDEALS OF MATTER

(b) *The* ideal *of matter. The old atomism strictly mechanical but inadequate. Its conversion into one strictly dynamical by Boscovich and the French. The resolution of this in turn into the 'kinetic theory.'*

The nature of the primordial fluid examined: it is made up of negations, and is thus indeterminate: prima materia.

Relation of its mass to the 'quasi-mass' of the vortices: the latter becomes a complicated problem. The kinetic ideal in danger from 'metaphysical quagmires.' To avoid this impasse *it is proposed to make energy fundamental.*

Results of inquiry into mechanical theory thus far: *Relation of the three sciences, Analytical Mechanics, Molar Mechanics, Molecular Mechanics. The first stands completely aloof from concrete facts. The attempt to apply it to these without reserve leaves us with a scheme of motions and nothing to move.*

To molar mechanics belongs the rôle *of stripping off the physical characteristics of sensible bodies; to molecular mechanics, the* rôle *of transforming these characteristics into mechanisms, and the mechanisms into 'non-matter in motion.' The mechanical theory as a professed explanation of the world thus over-reaches itself.*

As mechanical science has advanced, its true character has become increasingly apparent — its objects are fictions of the understanding, and not conceivably presentable facts.

The kinetic ideal shows this best of all, for some of its upholders dream of 'replacing' dynamical laws by kinematical. The refutation the more striking because they imagine they are all the while getting nearer to 'what actually goes on.'

It is upon an uncritical prepossession of this kind that the mechanical theory has rested all along. Descriptive analogies have been regarded as

actual facts; yet are nothing but the inevitable outcome of the endeavour to summarise phenomena in terms of motion. A moral drawn from the Pythagoreans.

But mechanical science has so far failed even to describe *facts in its own terms.*

We have found physicists protesting with great vehemence against being saddled with any metaphysical conceptions of matter as a substance underlying phenomena. Yet there is only one of the three chief theories of matter that might possibly clear itself of this stigma, and that is the old atomic theory of Democritus or Lucretius; but this, oddly enough, has always claimed to be a theory of substance. In point of fact it is the most phenomenal of all; for the hard atom, apart from its being *absolutely* hard, differs from tangible bodies only in respect of size and indivisibility. The collisions of such atoms again are essentially phenomenal, though actually beyond the limits of direct perception. Such collisions too are the very type of that plain, straightforward mechanical action, which alone Galileo, Newton, and Huygens — the founders of modern mechanics — were willing to recognise. You will remember the often-quoted letter of Newton to Bentley, in which he declared it to be "inconceivable that inanimate brute matter should . . . operate upon and affect other matter without mutual contact." This then is logically the one genuine and original mechanical theory. But absolute hardness is ideal and transcends experience, whereas for the physicist bodies are real and empirically given. I think we may say that whoever ventures to apply to any real thing such adjectives as 'absolute' or 'infinite' or 'per-

fect' or 'simple'—the terms being strictly used—has, however much he may dislike it, embrangled himself with metaphysics. Such at least has been the fate of the Lucretian atom, when defined as absolutely hard. Whether Lord Kelvin's perfect fluid fares any better, we can consider later. But let us first notice some of the antinomies besetting the older ideal atom.

Rigid bodies of sensible dimensions are described as respectively elastic or non-elastic, according as they do or do not resume their original shape after being strained. Absolute rigidity, however, absolutely excludes deformation, hence the hard atom can neither be elastic nor non-elastic. What then will happen when two such atoms collide? The problem is strictly indeterminate, so that—as has been said—as often as such an event occurs, the course of the world is at least as uncertain as an act of the purest free will could make it.[1] "Take a series of very inelastic bodies such as butter, lead, etc.," says P. du Bois-Reymond, "and then a series of very elastic bodies, such as india-rubber, ivory, etc. Of which of these two series is the absolutely hard the limit? Obviously of which we like, or of some mean between both."[2] If we decide to regard the atoms as non-elastic, then, when two collide, we must conclude that kinetic energy disappears without an equivalent amount of potential energy taking its place. If we prefer to regard them as elastic, we are then compelled to infer that their motions are instantaneously reversed, in other words, a finite momentum is produced in no time. And if we combine the two, we

[1] Kroman, *Unsere Naturerkenntniss*, p. 315.

[2] *Die Grundlagen der Erkenntniss in den exacten Wissenschaften*, p. 37.

combine these consequences; both of which contradict our fundamental axioms. The fact is that rigidity, whether accompanied by much or little elasticity, is not a property of mass as such, but a physical property of matter. But if a physical property, then rigidity has to be explained by dynamical transactions between masses, or the mechanical theory fails to redeem its pledge. In other words, it is not open to the physicist to explain — or, as is now said, to describe — rigidity and elasticity in terms of rigidity and elasticity. The retention or restitution of a given shape or configuration implies mechanical or dynamical relations between masses and has to be accounted for. So by inexorable logic the "many hard, impenetrable particles," which Newton was content to regard as "primitive," were resolved step by step into the mass-points or centres of force of Boscovich and the French analysts. But as contact action, *i.e.* action of the straightforward mechanical type, is impossible between mass points, it was replaced by action at a distance, sometimes attractive, sometimes repulsive, according as the distance or other circumstances might vary. The strictly mechanical theory became in fact strictly dynamical.

A word or two of historical explanation seems called for as to this opposition between two terms — I mean 'mechanical' and 'dynamical,' which are nowadays often regarded as synonymous. The term 'mechanical' however, seems appropriate only to motions produced by immediate displacement, as in machines, to contact action in other words. Newton, who — as we have seen — regarded action at a distance as "so great an absurdity,

that I believe," he writes to Bentley, "no man who has in philosophical matters a competent faculty of thinking can ever fall into it," finding himself unable *mechanically to explain* the working of gravitation, contented himself meanwhile with *describing* the motions produced. But he began early and persisted long in the attempt to discover some medium and mode of operation such as would enable him to explain gravitation by contact, instead of assuming it to be a force "innate, inherent, and essential to matter." However his friend and contemporary, the youthful Roger Cotes, though anything but a fool, rushed in where the master feared to tread. In his preface to the *Principia*, Cotes definitely asserted the doctrine of direct action at a distance, and maintained that gravity is no more an occult property of matter than extension, mobility, or impenetrability; since it was, he held, as plainly indicated by experience as they were. "And when"—I here quote Maxwell—"the Newtonian philosophy gained ground in Europe, it was the opinion of Cotes rather than that of Newton that became most prevalent, till at last Boscovich propounded his theory that matter is a congeries of mathematical points, each endowed with the power of attracting or repelling the others according to fixed laws. In his world, matter is inextended, and contact is impossible. He did not forget, however, to endow his mathematical points with inertia."[1] Thus Newton's position was exactly inverted. The solid primitive particles of various sizes and figures, in which Newton inclined to believe, were rejected; and the inherent forces acting through a vacuum, which he

[1] *Scientific Papers*, vol. ii, p. 316.

disclaimed as absurd, were accepted as the reality to which all the physical properties of matter were due. This is what I meant by saying that his strictly mechanical theory was transformed into one strictly dynamical.

One step in this transformation seems, as I have said, logically inevitable, the reduction of finite molecules to infinitesimal mass-points. Not so the second — the attribution to such mass-points of intrinsic forces. We have seen already that in abstract mechanics this conception of *vires insitæ* or substantial forces is rigorously scouted. Force is there a purely relative conception, a name for the rate of change of momentum of one mass referred to the position of other masses in the same "field." Unless then Boscovich's metaphysical idea of forces inherent in a mass-point can be replaced by the mathematical idea of external forces acting at a point, molecular physics cannot be regarded as merely dynamical in the looser modern sense. Central forces when not used geometrically, as by Newton, *i.e.* merely to *describe* observed motions, but metaphysically, to explain *action at a distance*, are incompatible with modern mechanics. They become part of what Professor Tait calls a "very old but most pernicious heresy, of which much more than traces still exist even among physicists."[1] But it must certainly be allowed that the progress of physics has steadily discredited this usage. Faraday's experimental researches into electricity and magnetism, the resolution of heat into "a mode of motion," and many other lines of investigation tend to confirm the kinetic ideal of matter, which has been aptly described

[1] *Properties of Matter*, art. x.

as the theory that matter is non-matter in motion — the non-matter, being of course, Lord Kelvin's ideal fluid.

It is this kinetic, or perhaps I should say hydro-kinetic, ideal of Lord Kelvin and his school, that, so far as I can gather, is the ideal of matter prevalent in the present day among such physicists as venture to stir beyond their equations. Any one with a weakness for Hegelian dialectic might easily discover the famous tri-adic development of thought in the advance from what was in the main Newton's ideal of matter through the ideal of Boscovich to that of Faraday and later British physicists. There seems to have been complete opposition between Newton's conceptions as to what matter really was and the descriptive apparatus of central forces acting across empty space by which he simplified and extended the more cumbrous apparatus of Kepler. Boscovich's doctrine was thus the precise antithesis of Newton's, for he took Newton's descriptive apparatus for the reality, and discarded his solid, impenetrable particles as false. Boscovich's atoms were strictly mass-points; occupation of space with him was due entirely to substantial forces, not to the absolute hardness of primitive particles; and all strictly mechanical action, depending on actual contact, was replaced by attractions or repulsions acting at a distance. The kinetic theory can be regarded as a synthesis of these contraries. There is no action at a distance; but then there is no empty space: action and reaction are to be explained, not by impact, but by the physical continuity of the plenum. There are no hard atoms; yet the atom occupies space dynamically and it is also elastic in virtue of its rotatory motion.

Faraday, who has been called a disciple of Boscovich, made the *first* step on in the course of his wonderful electrical researches. He shewed that in the part of space traversed by magnetic force there exists a peculiar tension; as Maxwell puts it, "that wherever magnetic force exists there is matter"—that is to say, an electro-magnetic medium or ether. Again Faraday's discovery of the magnetic rotation of the plane of polarised light, together with Maxwell's identification of the rate at which light and electro-magnetic disturbances are propagated, confirmed as this has been by the crucial experiments of Hertz, makes it reasonable to identify the luminiferous and electro-magnetic media. The *second* great step towards this new ideal begins with the mathematical investigation of Helmholtz into the properties of vortex motion. Though apparently not suggested by Faraday's work, the two were soon brought into connexion; for Lord Kelvin found that the medium when under the action of magnetic force must be in a state of rotation, that is to say, in Maxwell's words "small portions of the medium, which we may call molecular vortices, are rotating, each on its own axis, the direction of this axis being that of the magnetic force."[1] *Finally*, Helmholtz's demonstration of the conservation of vortex-motion in a perfect fluid led Lord Kelvin to his famous vortex-atom theory, of which I have already spoken, and which in its main features is known to everybody. According to the kinetic ideal of matter, then, both atoms and ether are resolved into motions of one ultimate fluid, which is defined as having "no other properties than

[1] *Scientific Papers*, vol. ii, p. 321.

inertia, invariable density, and perfect mobility; and the method by which the motion of this fluid is to be traced is pure mathematical analysis."[1]

Let me quote two versions of what is expected of this ideal from two of its most able and hopeful supporters. Dr. Larmor, in a paper in the Royal Society's Proceedings of 1893, writes: "It has been in particular the aim of Lord Kelvin to deduce material phenomena from the play of inertia involved in the motion of a structureless primordial fluid; if this were achieved it would reduce the duality, rather the many-sidedness, of physical phenomena, to a simple unity of scheme; it would be the ultimate simplification." This brief statement is clear and modest by comparison with the following deliverance of Professor Hicks in his *Address* to Section A at the last meeting (1895) of the British Association: "While on the one hand," said Professor Hicks, "the end of scientific investigation is the discovery of laws, on the other, science will have reached its highest goal when it shall have reduced ultimate laws to one or two, the necessity of which lies outside the sphere of our cognition. These ultimate laws — in the domain of physical science at least — will be the dynamical laws of the relations of matter to number, space, and time. The ultimate data will be number, matter, space, and time themselves. When these relations shall be known, all physical phenomena will be a branch of pure mathematics. We shall have done away with the necessity of the conception of potential energy, even if it may still be convenient to retain it; and — if it should be found that all phenomena are mani-

[1] Maxwell, *o.c.*, vol. ii, p. 471.

festations of motion of one single continuous medium — the idea of force will be banished also, and the study of dynamics replaced by the study of the equation of continuity."

Every sentence in these remarks would repay discussion, if we could spare the time. As it is, I must content myself with an occasional reference in the more general criticism of this ultra-physical ideal to which we may now pass. But first, I will ask your indulgence if I quote part of yet another paragraph from this presidential address. "Before, however, this can be attained," Professor Hicks continues, "we must have the working drawings of the details of the mechanism we have to deal with. These details lie outside the scope of our bodily senses; we cannot see, or feel, or hear them, and this, not because they are unseeable, but because our senses are too coarse-grained to transmit impressions of them to our mind. The ordinary methods of investigation here fail us; we must proceed by a special method, and make a bridge of communication between the mechanism and our senses by means of hypotheses. By our imagination, experience, intuition we form theories, we deduce the consequences of these theories on phenomena which come within the range of our senses, and reject or modify and try again. It is a slow and laborious process. The wreckage of rejected theories is appalling; but a *knowledge of what actually goes on behind what we can see or feel* is surely if slowly being attained."[1]

Now I think the whole drift of these statements, and particularly this last sentence, makes it abundantly plain

[1] *Nature*, vol. lii, p. 472; italics mine.

that Dr. Hicks — and I am sure he is not alone — regards the hydro-kinetic theory of matter which he passes on to discuss, *not* as so much descriptive parable or 'conceptual shorthand,' but as veritable, conceivably perceptible, reality; in short, "what actually goes on behind what we can see or feel." Very good. Let us now try to understand what this means.

If this primordial fluid is real, it must have some positive attributes, and it cannot be an abstraction. But it is defined as inert, incompressible, inextensible, inviscid, and structureless, all negative terms. It is useless to reply that it is quite indifferent whether we use words that are positive, or words that are negative in form; that, in fact, this primitive fluid can be equally well defined as massive, of constant density, perfectly mobile, and absolutely homogeneous and continuous. Leaving the question of mass or inertia aside for a time, — we shall have to deal with it more at length, presently, — the remaining properties are, I take it, all summed up in the one phrase 'perfect fluid.' And as all the fluids we know are *im*perfect, it might seem that the negation belongs to the known, not to the unknown. But to say nothing of the obvious impossibility of this, we find that the characteristics of an imperfect fluid, one and all, refer to experimental facts. All liquids are compressible, viscid, and more or less discrete or structural. Let me cite a witness who has some claim to speak on such a point, I mean Clifford: — "A true explanation describes the previous unknown in terms of the known; thus light is described as a vibration, and such properties of light as are also properties of vibrations are thereby

explained. Now a perfect liquid is not a known thing, but a pure fiction. The imperfect liquids which approximate to it, and from which the conception is derived, consist of a vast number of small particles perpetually interfering with one another's motion. . . . Thus a liquid is not an ultimate conception, but is explained—it is known to be made up of molecules; and the explanation requires that it should not be frictionless. The liquid of Sir William Thomson's hypothesis is continuous, infinitely divisible, not made of molecules at all, and it is absolutely frictionless. This is as much a mere mathematical fiction as the attracting and repelling points of Boscovich."[1] Even Professor Lodge, though a sturdy upholder of the hydro-kinetic ideal, seems willing to allow the impropriety of the term 'fluid.' "Ether," he says, "is often called a fluid or a liquid, and again it has been called a solid, . . . but none of these names are very much good; all these are molecular groupings, and therefore not like ether [the name Professor Lodge applies to this primitive medium]; let us think simply and solely of a continuous frictionless medium possessing inertia, and the vagueness of the notion will be nothing more than is proper in the present state of our knowledge."[2]

Very good; again leaving aside for a moment the property of inertia, let us think simply and solely of this "continuous frictionless medium," neither ordinary fluid nor solid. Wherein does it differ from space? Space too is incompressible, inextensible, frictionless, and structureless, and it furnishes the very form and type

[1] *Lectures and Essays*, 1886, p. 169 f.

[2] *The Ether and its Functions, Nature*, vol. xxvii, p. 305.

of a continuous medium. But whereas space is a perfect vacuum, it will be replied, our medium is a perfect plenum. But from empty space to masses in motion is a distinct step and from a uniformly filled space the step is just as distinct. So far as the realisation of any form or motion, thing or process, is her one aim, Nature ought to abhor such a plenum quite as cordially as she is said to abhor a vacuum. But the primordial medium has mass, we shall be reminded; in other words, it is inert, and inertia at least is a definite and fundamental physical fact. Let us now, then, inquire whether this remaining attribute of the universal medium renders it any more determinate, or whether, as so applied, 'inert' is anything better than another negation.

Inertia as a qualitative term and in its primary sense of inability or incapability is obviously negative. So Young defined inertia as the incapability of matter to alter its existing state except under the influence of some external cause. To allow that this universal plenum has inertia then does not remove its indeterminateness. Before it can be determined or differentiated in any way, some cause must intervene entirely from without, and such intervention will not admit of physical description. Such cause is of the nature of creation or miracle; it is neither a force in the sense of the attractions or repulsions by which Boscovich and Kant sought to explain matter, nor is it force in the modern sense of mass-acceleration. In other words, in the kinetic ideal of matter we shall find that the notion of mass is used with two distinct and inconsistent connotations. Abstract mechanics, as we have seen, sets out

from definite masses or bodies having assignable positions, between every two of which there are dynamical transactions. *Two* masses, that is to say, measure each other by their mutual accelerations; in other words, mass is a strictly quantitative notion, and as such implies relation to a standard. Not only is mass in this wise always a relative quantity, but it is relative again in implicating the correlative notion of moving forces or stress between masses, which, as just said, is the only means of determining mass. When, however, the notion of mass is applied to a universal homogeneous plenum, it lapses back into the merely qualitative notion of incapability of change evenly diffused through all immensity. And definite forces — necessarily present where there are definite masses to interact — seem here excluded. I trust I am not mistaken on this point. But it is difficult to imagine what definite forces there can be. Everything chemical or thermal or electrical is excluded, for the medium is throughout homogeneous and structureless. In like manner gravity, elasticity, and cohesion seem incompatible with absolute inviscidity and uniform density. Accordingly, to secure stability, when this medium is churned up into a labile ether it must be provided with a fixed boundary or be extended to infinity. Mathematically these alternatives may come to the same thing, though the latter, *i.e.* infinite extension, seems the simpler and less arbitrary of the two, again shewing how little there is to choose between a vacuum and this plenum. The properties of such a plenum, indeed, as Maxwell chanced to remark[1] a year before Lord Kelvin's great

[1] *Scientific Papers*, vol. ii, p. 26 (on *Dynamic Theory of Gases*).

hypothesis was broached, "may be dogmatically asserted but cannot be mathematically explained." The reason for this seems simple: such a medium does not furnish even to abstract mechanics any *ποῦ στῶ*.

However, assuming that in some ultra-physical fashion it has been whisked up into that state of turbulent motion to which Lord Kelvin has given the name of "vortex-sponge,"—this being the first step in cosmic confectionery,—let us see how this primitive mass is related to the phenomenal masses that then appear. The point I wish to urge is that neither the one nor the other conforms to the conception of mass with which abstract mechanics set out. The mass of every portion of the primitive fluid is an inalienable property of that portion. So far good, of course. Again, since the fluid is, and ever remains, of uniform density, the primitive or 'actual mass' of every portion is proportional to its volume. A vortex-ring is such a portion. But now its mass as measured by its mechanical effects is not simply proportional to its volume; in determining this 'effective mass,' the 'strength' of the vortex, *i.e.* its rotational motion, is also a distinct and independent factor. In short, this quasi-mass, or "non-matter in motion," depends upon a number of conditions, of which the real or primitive mass is only one. Such quasi-mass is therefore not an inalienable property in the sense in which primitive mass is such. For instance, though the volume of a vortex is constant, and therefore its primitive mass also, its configuration is liable to vary—in which fact of course lies the chief merit of the vortex-atom. But on these variations in its con-

figuration depends the extent to which other portions of fluid are carried along with the vortex, as it moves onwards. Thus, while its primitive mass is invariable, its effective mass may vary with its motion and configuration.

We are brought, in short, to this paradoxical result: First, mechanical mass, the mass we know, is resolved into a mode of motion of some ultra-physical mass not directly capable of mechanical transactions, a mass that we therefore do not, and cannot, know as such. Given so much space, there is given also so much of this ultra-physical mass; but how much or how little nobody can say. Our scientific teachers have trespassed unawares beyond the limits of the phenomenal, and we find ourselves bowing down to a 'fetish' after all, none other indeed than that hoary idol of metaphysics, *τὸ ἄπειρον*, *materia prima*,[1] qualitatively indeterminate and quantitatively indistinguishable from space. Secondly, a mechanical, effective, or apparent mass, instead of being a constant and ultimate physical quantity, as at first defined, proves, so Professor Hicks tells us, "a much more complicated matter, and requires much fuller consideration than has been given to it." It may even, he thinks, "depend to some extent at least on temperature, however repugnant this may be to current ideas." Thus in this endeavour to carry through the application of abstráct mechanics to all physical phenomena, the conception of mass proper has got pushed over the brink of the sensible and empirically verifiable, and seems in danger of being lost in those terrible

[1] Cf. Descartes, *Les Principes de la Philosophie*, bk. ii, art. 5.

'metaphysical quagmires' at which, as we have seen, the reputable physicist shudders. So now, instead of having this conception to the good in explaining or describing physical phenomena, the *semblance* of mass has itself to be accounted for; and this, as we have just been told, is a very complicated business "requiring much fuller consideration than has been given to it." The *impasse* which thus threatens to end the kinetic ideal of matter was clearly seen by Maxwell and is admitted by Lord Kelvin. In the article '*Atom*' in the *Encyclopædia Britannica* Maxwell thus criticises it: "Though the primitive fluid is the only true matter, according to the kinetic ideal that is to say, yet that which we call matter is not the primitive fluid itself, but a mode of motion of that primitive fluid. . . . In Thomson's theory therefore the mass of bodies requires explanation. We have to explain the inertia of what is only a mode of motion, and inertia is a property of matter, not of modes of motion." Lord Kelvin himself, in concluding his lecture on '*Elasticity as a Mode of Motion*,' acknowledges that "this kinetic theory of matter is a dream and can be nothing else, until it can explain," not only the "inertia of masses (that is, crowds) of vortices," but also gravitation, chemical affinity, and much besides. His only ground of confidence appears to be the "belief that no other theory of matter is possible."[1] But this was in 1881; and one cannot help wondering whether Lord Kelvin's confidence in his theory has increased or diminished in the meantime. Some among the younger generation of physicists pre-

[1] *Popular Lectures*, vol. i, p. 145.

fer, as I mentioned in the last lecture, to abandon the attempt to reduce all physical phenomena to a connected mechanism based solely on the Newtonian laws. Many of them look to find a better way by taking, not mass, but energy, for the fundamental notion. Before we pass on to this, however, it will be well to try to gather up the main results of our inquiry into the mechanical theory so far.

We have distinguished three branches of science which, though distinct, are closely connected and often confused: (1) Pure, or Analytical Mechanics; (2) Mechanics applied to Molar Physics, which might be called Molar Mechanics; and (3) Mechanics applied to Molecular Physics, or Molecular Mechanics. The first is in the strictest sense an exact science based on certain fundamental assumptions and definitions. We have here rigorous calculation, but not concrete measurement: ideas, but not facts. The other two rest in part on observation and experiment, which yield approximate measurements, probable values, *i.e.* averages and means corrected by the help of that — for the student of knowledge — most wonderful instrument, 'the logic of chance.' In the exact sciences, within the limits of our powers and subject only to the laws of thought — we are complete masters of the situation. Our intellectual constructions are archetypal and not ectypal. We can here give a meaning to absolute time, absolute space, absolute motion; we can here talk reasonably of the perfectly continuous, perfectly discrete, and perfectly constant. But applied to the particulars of experience such conceptions have no warrant. The Pythagorean

proposition, for example, is exact and certain, apart from all physical circumstances as a proposition in plane geometry. But, as Riemann's famous dissertation suggests, it is quite conceivable that this proposition should be falsified one way in astronomical measurements, if the distances measured were sufficiently vast; and be falsified another way — in mineralogical measurements, say — if these distances were sufficiently minute. Of course we might prefer to consider our lines as not really straight. This, however, might quite well only mean changing one contradiction for another, or prove far less simple than it would be to describe the facts in terms of some non-Euclidean space. But worse than this and far less open to dispute: the most elementary conditions of absolute exactness everywhere fail us. We have no fixed points, no fixed directions, no accurate timekeeper, not one *demonstrably* constant property of a physical description. Even number when applied to physical phenomena is no exception, in so far as neither identity nor simplicity nor discreteness admit of more than a relative application.

Now, as a consequence of all this, if you like—as the price of its formal exactness, abstract mechanics has to renounce those higher categories, Substantiality and Causality, which bring us into touch with concrete things. The process of eliminating these categories has been slow; for the terms 'mass' and 'force' seem almost inseparably associated with substance and power, from which notions in fact they were primarily derived. But regarding the elimination as at last complete, and accepting the purely mathematical definitions of mass and force

now in vogue, the bearing of this result on molar and molecular mechanics is important. The simplest and most comprehensive description of the movements, actual or supposed, that occur in nature becomes the sole aim of these sciences, not the unveiling of the mystery of matter or the knowledge of the causes of things. The logical development of this procedure we have attempted to follow in some detail, and the outcome, as we have just seen, is that we find nothing definite except movement left. Heat is a mode of motion, elasticity is a mode of motion, light and magnetism are modes of motion. Nay, mass itself is, in the end, supposed to be but a mode of motion of a something that is neither solid nor liquid nor gas, that is neither itself a body nor an aggregate of bodies, that is not phenomenal and must not be noumenal, a veritable *ἄπειρον* on which we can impose our own terms. I am sure this process will remind many of you of one of *Alice's Adventures in Wonderland*. I trust I may be pardoned for the allusion. The Cheshire Cat, you remember, on a certain occasion, "vanished quite slowly, beginning with the end of the tail and ending with the grin, which remained some time after the rest of it had gone. 'Well! I've often seen a cat without a grin,' thought Alice, 'but a grin without a cat! It's the most curious thing I ever saw in all my life.'"

In this advance towards what looks like physical nihilism, molar and molecular mechanics constitute each a distinct step. The salient feature we have noted in molar mechanics is that 'species of abstraction' that Thomson and Tait describe as 'limitation

of the data.' Of such abstractions we have an instance in the treatment of the constraints and connexions that limit the free motion of a particle or of the separate portions of a machine, as mere geometrical or kinematic conditions. In actual fact constraint involves friction, strings stretch, levers bend, and so on. But all these imply intermolecular forces, the investigation of which is passed on to experimental physics. Again a change in the momentum of a body may be due to any one or more of a variety of causes—gravitation, heat, chemical action, and so on. Molar mechanics considers none of these: it is concerned only with the rate of the change itself, giving, as we must remember, the name of 'moving force' to this *effect*. The various causes, as we are allowed provisionally to call them, are, as before, passed on to corresponding departments of experimental physics. Finally the bodies moving have manifold properties. Of these all save mass and mobility are ignored, and the rest again passed on to experimental physics.

But now assume for a moment that molecular mechanics has fully accomplished the task assigned to it, I mean this mechanical interpretation of the facts of experimental physics. None of those conditions of constraint, none of those natural forces or physical properties, which molar mechanics passed on, will then be left over; all of them will have been described in terms of mass and motion. It is thus obvious that that 'species of abstraction' or limitation so characteristic of the methods of molar mechanics does not pertain to molecular mechanics. On the contrary, that

science, if verily complete, would — we have been told — embrace in one scheme all the vast variety of physical phenomena reduced to the simplest possible form. True, its fundamental ideas would be the same as those of pure mechanics, but then we should be assured that there were no others, whereas in molar mechanics this still remained an open question. In fact this last science would itself be absorbed; inasmuch as a body of sensible dimensions would be but an aggregate of molecules, and all those of its properties, left aside as non-mechanical in the aggregate, would be referred to mechanical processes in the parts. It is allowed, of course, that molecular mechanics is *not* complete; and we have seen that its procedure, when seeking to express the facts of chemistry, light, electricity, etc., in purely mechanical terms is in the main hypothetical and indirect. Molecules, Atoms, Ethers, *Prima Materia* — one and all are hypothetical. "Nevertheless," say the naturalists, "they are thoroughly sound hypotheses and their scientific value is enhanced daily both by known facts that they are continually assimilating, and new facts that they are continually revealing. We realise that there is still much to do, but at the same time we are confident that 'no other theory of matter is possible.' Our scheme is therefore regarded as established in principle despite important gaps in detail."

Now it is this advance — from dynamical theory, as a branch of pure mathematics, through molar mechanics, as an abstract application of that theory, on to molecular mechanics, in which all physical phenomena are subsumed under it — that vitally concerns us. A science

which at the outset is simply formal and quantitative seems in the end to yield the ideal of concrete physical existence, what Kant might have called the *omnitudo realitatis* of the physical world; and this becomes, for those to whom the physical world is primary and fundamental, the supreme and only *omnitudo realitatis* that science can ever know. Here, then, we have that advancing tide of matter which, as Huxley says, "weighs like a nightmare on the best minds of these days." But surely if our account of this transformation of pure mathematics into concrete physics is correct, the baleful spectre should be dispelled, and that without any recourse to such an agnosticism as Huxley's. The mechanical theory, in a word, as I have already hinted, refutes itself by proving too much. Or, to put it otherwise, and more fairly: the mechanical theory, as a professed explanation of the world, receives its death-blow from the progress of mechanical physics itself.

As long as the ideal of matter consisted of the "solid, massy, hard, impenetrable, movable particles of various sizes and figures" (such as Newton supposes in his *Opticks*), maintained in various states of vibration, rotation, and translation by their mutual encounters; so long this ideal of matter answers to Newton's conception of a *vera causa*. But the simple atom or centre of force of Boscovich, and the primitive fluid of Lord Kelvin, are not *veræ causæ*: we must not call them fetishes, but they are assuredly fictions. To Newton's particles we *might*, perhaps, apply Dr. Hicks's words: "They lie outside the scope of our bodily senses; . . . not because they are imperceptible, but because our senses are too coarse-

grained to transmit impressions of them to our minds." To bodies wholly devoid of extension, or to a plenum wholly devoid of differences, such language cannot be applied. The process of analysis up to the stage of the chemical or physical molecule, though hypothetical and indirect, may yet be regarded as *real* analysis; and had the hypothesis of extended molecules proved adequate, the mechanical theory might, so far as science goes, have held its ground. Extended, solid, indestructible atoms have always been the stronghold of materialistic views of the universe. But, unhappily for such views, the hard, extended atom was not equal to the demands which increasing knowledge made upon it. Then, as we have seen, encouraged by Newton's essentially descriptive conception of distance-action, the old atom shrank up gradually, surrendering all its extension, rigidity, and elasticity, till it became identical with the entirely formal conception of analytical mechanics, that, viz., of a mass-point as a centre of force. But this later analysis, though still hypothetical, had no longer any conceivable physical counterpart. The supposition that it had was due solely to that failure to realise the purely descriptive character of mechanics which its increasing mathematical formulation and its liberation from the categories of substance and cause have now made clear. It fell to Père Boscovich decently to inter the genuinely mechanical theory as an explanation of physical phenomena. There was no rest for the old atom till it took this ghostly form of a mass-point, and thenceforward it was a dynamical fiction, pure and simple.

Lord Kelvin's brilliant hypothesis of vortex-atoms, if

regarded as an endeavour to resuscitate indestructible and extended atoms as realities, and to provide a medium for their interaction, must be pronounced a failure too. Boscovich resolved the palpable atom into an idea ; Lord Kelvin seems to attempt the converse and far harder feat of calling back this atom from a "vasty deep" so dangerously like pure being as to be, phenomenally, pure nothing. The endeavour to attribute mass to this continuum is as if one should let one's plummet drop in the hope of sounding a fathomless sea ; we lose a simple conception, and have a complex one left on our hands instead. But now comes Dr. Hicks to persuade us that we gain more than we lose : "If it should be found that all phenomena are manifestations of motion of one single continuous medium, the idea of force will be banished [the relative idea, that is, of which mass is the correlative] . . . and the study of dynamics will be replaced by the equation of continuity ;" for "where all the matter is of the same density the motions are kinematically deducible from the configuration at the instant, and are independent of the density."

These remarks are most opportune. If we consider them for a moment, they ought to satisfy us that we are *not* penetrating beyond what we see and feel to anything that actually goes on behind the too coarse-grained veil of sense. They serve to shew, on the contrary, that the kinetic ideal also is but a fiction of the mathematician, a descriptive symbol, and not conceivably a presentable fact. Now there is a certain philosophical doctrine, both psychologically and epistemologically of fundamental importance, that ought to

be well known in Aberdeen[1] — I mean the doctrine of the relativity of knowledge. The range of this doctrine may be very much a question, but at least no one will deny that it applies here. See then to what it leads. Everything perceptually real, everything phenomenal, whatever can be an object of possible experience, implies difference and change. But we have left all sensible qualities except density behind us; and this, though retained, is to admit of neither difference nor change. "*Idem semper sentire et non sentire ad idem recidunt*," says the doctrine of relativity. For any conceivable experience then this density is as nothing. Moreover, according to the kinetic theory, the motions are independent of it. Why then is it retained? Apparently to stand between us and nonentity. It secures for us that "idea of *stuff* or *substance* which," Professor Tait tells us, "the mind seems to require" — well for comfort![2] It is then *das reine Sein* of our present universe of discourse. Or it is the 'Achilles heel' of reality, left when all the rest of the physical world has been dipped in the Styx. "But why," asked an intelligent child, "did not Thetis dip Achilles twice?" Now Dr. Hicks appears to have had that much foresight in agreeing to let go dynamics and to abide by the equation of continuity. For dynamics and mass must surely vanish together, and we have properly only kinematics left. Nevertheless there remains one stipulation that kinematics does not warrant — there must be no discontinuity in the

[1] Being so strenuously maintained by Dr. Bain.

[2] *Unseen Universe*, p. 105.

motions on two sides of a geometrical boundary. The vortices, in other words, must not spin and leave the medium unaffected; and so the medium, being involved in the movement of one vortex, must in turn affect the movements of another. And thus with this proviso the whole becomes, as we may say, one vast quasi-dynamical or rather quasi-kinematical system. For it is allowed,[1] I believe, that the existence of surfaces of finite slip is not precluded by the bare conception of a uniform frictionless medium. Imagine such an ideal fluid if you can, and the question whether a vortex in it will or will not affect the fluid outside the vortex is altogether indeterminate. It may do either or neither, sometimes the one and sometimes the other. Why then is this condition of motional continuity imposed from without? Simply to make the thing work *mathematically*, that is to say, to insure connexion and continuity between one kinematical configuration and another. Without it we might have vortex-atoms as before, but not "actions excited by these vortices on one another through the inertia of the fluid which is their basis."[2] For such mutual regard is not a direct consequence of the common plenum. In fine, then, this additional property of motional continuity is asserted, though it cannot be deduced, in order to make possible a kinematical scheme that *replaces*, as Dr. Hicks says, the dynamical laws that can then be left behind.[3]

[1] See letter on *Vortex-atoms*, by Professor G. H. Darwin, *Nature*, vol. xxii, p. 95. [2] Dr. Larmor, Proc. R. S., 1893, p. 439.

[3] "It will be seen that the work is almost entirely kinematical; we start with the fact that the vortex-ring always consists of the same parti-

It may be that this exposition by the President of the Physics Section of the British Association sounded rash, or at least premature, to the distinguished physicists who heard it. But it must certainly be impressive to any humble outsider with a philosophical bent. It exhibits strikingly the complete logical outcome of the problem of mathematical physics, as formulated by the Kirchhoff school; and all the more strikingly because this consequence is here worked out, as it were unconsciously, by one who, unlike Kirchhoff, seems to suppose that he is all the while getting nearer to "what actually goes on" in the real world. The tendency to extend kinematics at the expense of dynamics seems inherent in this new conception of physics. But the sounder the conception, the more this tendency may be expected to assert itself spite of contrary prepossessions, and the more effectively will such prepossessions be dispossessed.

Now it is entirely upon these uncritical prejudices, as we may fairly call them, that the mechanical theory of the world rests. The more they are discredited the more it is discredited through them, and this, I believe, the history of science will amply show. The transference of motion by impact, for example, as when two billiard balls collide, seems the type of plainness, and so

cles of fluid (the proof of which, however, requires dynamical considerations), and we find that the rest of the work is kinematical. This is further evidence that the vortex theory of matter is of a much more fundamental character than the ordinary solid particle theory, since the material action of two vortex-rings can be found by kinematical principles, whilst the 'clash of atoms' in the ordinary theory introduces us to forces which themselves demand a theory to explain them." Professor J. J. Thomson, *A Treatise on the Nature of Vortex-Rings*, 1883, p. 2.

long as this and other equally familiar experiences were accessible to the imagination, it seemed still to retain its grasp of the real despite 'the cloud of analytical symbols.' The triumph of the undulatory, over the corpuscular, theory of light, was a blow to such realism; for an imponderable ether was not easy to conjure up by imagination. Still, after all, waves are familiar and it was only the 'undulating agency' that was obscure. But a severer blow overtakes us in what we might call the demolition of the chemical atom as an assured stronghold of the realistic imagination. And when both chemical elements and luminiferous ether are resolved into motions of a medium, 'the dynamics of which is not the dynamics of ordinary matter,'[1] realism seems fairly routed.

But stranger still, imagination has become itself a traitor to mechanical realism—I refer, of course, to such ingenious mechanical analogies as those, for example, by which Maxwell succeeded in elucidating electro-magnetism. For analogy is an important aid to description, though powerless to prove existence. Nevertheless, as I had occasion to remark in the last lecture, even the ablest men are apt to see more in analogy than this; and it speaks volumes for Maxwell's strength of intellect that, acute as he was in the discernment of helpful analogies, he seems never to have been led away by them. But it is a case in which there is safety in numbers. A thinker familiar with many analogies is less likely to be betrayed by them than a thinker whose mind is enchanted by one. Now Boltzmann, in an instructive paper

[1] Larmor, *Nature*, vol. liii, p. 4.

on the *Methods of Theoretical Physics* from which I have already quoted once or twice, gives many instances of surprising and far-reaching analogies that have been discovered within the last half-century between physical phenomena apparently quite unlike; as if nature had "built up the most diversified things after exactly the same pattern." "As the analyst dryly observes, the same differential equations hold for the most diversified phenomena." And no great wonder if the analyst had previously made up his mind to see the most diversified phenomena merely as cases of motion, to be described in the simplest and most comprehensive manner.

The logical goal of such a project, I conclude then, is— so to say—to minimise the inevitable '*matter*' of phenomena and to bring all the diversity possible under the '*form*' of motion. This goal is already set before us in the kinetic ideal of matter, where dynamics is all but sublimated into kinematics. So much so indeed, I may remark by the way, that even the motion is absolute, and not merely relative, motion; for every motion is strictly a motion of the medium, and this is infinite and all there is. Now, as soon as we are asked to entertain the notion of absolute motion, we may satisfy ourselves that we have left everything phenomenal behind us and are once again entirely in the region of the abstract conceptions of exact mathematics. And the medium itself, though infinite and all there is—nay, because of this, for it does not allow even the distinction of body and space—is indistinguishable from nothing. The whole ideal, it seems to me, *if it be meant to set before us what verily is and happens*, was refuted long ago by Leibnitz

in the following sentences of the *Monadology* (§ 8): "If simple substances did not differ at all in their qualities, there would be no way of perceiving any change in things, since what is in the compound can only come from the simple ingredients, and if the monads were without qualities they could not be distinguished the one from the other, since also they do not differ in quantity. Consequently, a plenum being supposed, each place in any movement could receive only the equivalent of what it had before, and one state of things would not be distinguishable from another."

We smile at the critical simplicity while admiring the boldness of the Pythagoreans, according to whom, as Aristotle tells us, "Number is the essence of all things; and the organization of the universe, in its various determinations, is a harmonious system of numbers and their relations." Enough perhaps is known of the Pythagoreans and their tenets to shew that they had no pure science of number, but that such arithmetical knowledge as they had was encumbered by concrete and fanciful associations with numbered things. May we not apply the moral to the mechanical theory of the universe, and say that the more clearly the purely mathematical character of mechanics is realized, the more absurdly inadequate that theory becomes? A science that can only offer us as its ultimate scheme of the universe the inconceivable ideal of continuous motion in an unvarying plenum, is surely as incompetent as arithmetic or geometry to furnish a concrete presentment of a real and living world. Its essentially formal character has become increasingly evident with every

improvement in its methods. Galileo and Newton made many experiments, and their works abound in diagrams; but I am not aware that either Lagrange or Laplace* ever tried an experiment, while Lagrange is said to have boasted that his *Mécanique analytique* did not contain a single figure. This science, then, which has gradually rid itself of the categories of substance and cause, which works entirely with abstract quantities, expressing its conditions in equations and its results in equations, does not, and cannot, yield any direct knowledge concerning *real* things. When employed to describe them, its application is restricted absolutely to the one quantitative aspect with which it deals,—the motions of mass-systems. It has no scientific status except where such motions are either (1) given, or (2) inferred, or (3) assumed. In the first case its results, though necessary and exact in themselves, become at once hypothetical and approximate in their application; the ideal simplicity and abstract isolation of theory being never found in reality. In the second case the results are more hypothetical and approximate still; for neither the particles nor the motions themselves can be directly measured. This is the region of statistical probabilities. In the third, the masses and motions are *entirely* hypothetical; it is no longer, strictly speaking, a case of applying pure mechanics to describe real motions. This is the region of mechanical analogies, of prime atoms and ethers, vortices and primordial fluids; the region in which, as Dr. Hicks has told us, "the wreckage of rejected theories is appalling."

The mechanical theory of the universe, then, begins

* See Note viii, p. 589.

with abstractions, and in the end has only abstractions left; it begins with phenomenal movement and ends by resolving all phenomena into motion. It begins with real bodies in empty space, and ends with ideal motions in an imperceptible plenum. It begins with the dynamics of ordinary masses, and ends with a medium that needs no dynamics or has dynamics of its own. But between beginning and end, there are stages innumerable; in other words, the end is an unattainable ideal. First, we have sensible mechanisms; to these theoretical formulæ only apply approximately, their abstract simplifications being inadequate to cope with the 'practically infinite' complexity of the reality. A closer approximation is secured, but at the cost of new residual discrepancies, by resolving the parts of sensible mechanisms into smaller mechanisms, and the parts of these into others yet smaller in turn. Again, further approximations are made by attributing other elements of the real complexity to imaginary mechanisms of many orders. But the complexity being, as said, 'practically infinite,' this procedure has no prospect of ending. Dr. Hicks, for example, even when he has got as far as the chemical atom,— and that, we must remember, is a very long way,— cheerfully tells us, "The atom is much larger than a cell, and contains, practically, an infinite number of them;" a cell, I must tell you, being an imaginary box that Dr. Hicks has devised, in which a vortex of the primary medium is magically penned up to wriggle. Yet, despite these complex mechanical fictions, *no* advance is yet reported towards a kinetic theory of gravitation, and very little has been done with the terrible complica-

tions of chemical affinity. The story of the progress so far is, then, briefly this: Divergence between theory and fact one part of the way, the wreckage of abandoned fictions for the rest, with an unattainable goal of phenomenal nihilism and ultra-physical mechanism beyond.[1] Nevertheless, there are many who hold that the world must be such a mechanism, because they imagine themselves unable to conceive it otherwise. Such, as I understand it, is Lord Kelvin's position, for example. Others see in the situation a parallel to that of the Ptolemaic astronomy, which could not cope with increasing knowledge even with the help of new eccentrics and epicycles, freely assumed as the occasion arose. A new and simpler science of energetics is with some of these reactionaries the counterpart of the Copernican astronomy, and is to release physics from the complications in which mechanics has involved it. These are points that must occupy us in the next lecture.

[1] This passage is quoted by Sir Arthur Rücker in his Presidential Address to the British Association in 1901, in which he seeks to defend the reality of 'ultra-physical entities.' I have tried to deal with his position in a Supplementary Note, see pp. 303-315 below.

LECTURE VI

THE THEORY OF ENERGY

The proposal to replace Mechanical Physics by Energetics. Whatever it may be worth, this proposal at least puts Mechanical Physics anew upon its trial.

I. What is energy? *Professor Tait's definition of Matter as the 'vehicle or receptacle of Energy' examined. Relation of Energy to Matter. Helmholtz's exposition of this relation. Relation of Energy to Mass. Is not Mass as much an analytical abstraction as Force?*

All change either a transference or a transformation of Energy, and Kinetic Energy only one *form of actual energy — this is the new doctrine. Difficulties of the old theory which is bent on resolving all actual energy into kinetic energy. Professor Duhem's protest, and some reflections that it suggests.*

Returning to the new theory we note (i.) that quantitative equivalence not qualitative identity is all that is asserted of the several forms of energy; and (ii.) that some of these forms may still remain undiscovered. Some final reflections on the mechanical bias.

II. What is the Conservation of Energy? *What it is not; it does not warrant statements about the past or future of the universe. It does not mean that Energy is verily and absolutely the substance of the universe. Its relativity. Its character as a postulate. Implications of this, and new questions opened up.*

In the preface to the *Principia*, it will be remembered, Newton gave expression to his hope that if the mechanical principles he had laid down should prove inadequate to the explanation of "the other phenomena of nature, they might at least afford some light to a more

perfect method of [natural] philosophy."[1] The inquiry which has occupied us for the last two lectures seems to shew that the first alternative is well-nigh, if not quite, hopeless. In place of simplifications of actual phenomena it offers us fictitious mechanisms; or mechanical analogies, in which quasi-rigidity, quasi-elasticity, quasi-mass, and quasi-matter meet us at every turn. One recent writer, the brilliant German physicist, Hertz, did not shrink from assuming that the underlying mechanism, by which he proposed to explain the effects we perceive, consists of hidden masses and motions that exceed by an infinite number the masses and motions to be described.[2] And even with all this more than poetic license it has not been found possible to resolve electrical and chemical phenomena into motions, to say nothing of the phenomena of organic life. Yet all these phenomena, it is said, are clearly amenable to the principle of the conservation of energy. In spite of the physicist's complete ignorance as to what the mechanism of electricity, for instance, may be—if indeed it has any mechanism at all—'electric current' can be produced, measured, and retailed to consumers like other commodities; and it is so far under control that it can be transformed into its equivalents of heat, light, or motive power. Nay, but for a knowledge of these transformations and their mechanical equivalents, the mechanical treatment of physics could not have advanced as far as it has. Here then is a principle universal in its range, independent of atomic hypotheses and fictitious forces, confirmed by innumerable experiments and contradicted

[1] Cf. Lecture III above, p. 84. [2] *Principien der Mechanik*, § 664.

by none, a principle that verily brings all physical phenomena, mechanical as well as the rest, under a single *real* scheme, surely this, it is said, is the true integral law of the world. And so just forty years ago Rankine sketched "the outlines of the science of energetics." The project has never been lost sight of, and within the last few years it has been pursued with ardour in many quarters, especially in Germany and in France. The views of the extreme upholders of this new science are still *sub judice*, so much so that it would ill become me as a complete layman in such questions to venture any opinion. But the doctrine of energy is fully admitted even by those physicists who are not prepared to yield it precedence over the old Newtonian mechanics. At the same time the more progressive doctrines are at least effective as criticisms of the older view. They are a new outgrowth, which, if it does not displace, must at least profoundly modify the older form. For these reasons it has seemed to me best to reserve the discussion of this subject till now, and to do so was easy, as the mechanical ideal contrives to dispense with all forms of actual energy save the old *vis viva*. And let me remark, by the way, that energy, as I understand, is to be regarded as a physical fact and not as a mathematical conception; in discussing it and the criticisms of the mechanical theory that it suggests, we are not then concerned with abstract mechanics as a branch of mathematics, but only with mechanics applied to physical phenomena.

This becomes evident when we ask: What is energy? It is in the answer to this question that we come upon

the new wine that is to try the old bottles of the mechanical theory; for energy is so defined as to threaten the independent existence of that matter which was first of all regarded as its necessary substratum. Thus Professor Tait informs us that "in the physical universe there are but two classes of things, Matter and Energy." Further, that as "energy is never found except in association with matter . . . we might define matter as the *Vehicle* or *Receptacle of* Energy."[1] *Vehicle*, I presume, we are to take as the appropriate simile where the energy is actual and changes are in process; *receptacle*, when the energy is only 'stored,' and changes are only potential. But either way these figurative expressions distinctly imply that we know by experience each of these two things, just as we know and distinguish the cycle and the rider, the basket and its contents. The appropriateness of such language turns entirely on the question whether or no we have such knowledge. It will not do to say: We *must* have it, since we know that both matter and energy are conserved. We shall come to that presently; but it is plain our knowledge cannot begin there. To know such laws *about* the things, we must first have some sensible acquaintance with the things themselves. We get a little nearer to what we want when Professor Tait goes on to say: "Matter is simply passive (*inert* is the scientific word); energy is perpetually undergoing transformation." But surely to be perpetually *undergoing* transformation is no better than the dreariest picture of unmitigated passivity. However, Professor Tait continues: "the one

[1] *Properties of Matter*, pp. 2, 4.

[matter] is, as it were, the body of the physical universe; the other [energy] is its life and activity."[1]

Our question, then, can now be more precisely put; it is not, What do we or what does Professor Tait know *about* this simply passive thing, this inactive unchangeable body, as it were; 'scientific words' like inert, conservation, and the like, being used. The question is: What sensible acquaintance have we with the thing itself? Now it is remarkable that, although the book I have been quoting is entitled *Properties of Matter*—Professor Tait proceeds to say: "From the *strictly* scientific point of view the greater part of the present work would be said to deal with energy rather than matter;" and he only justifies the title he has used on "the two grounds of custom and convenience." We are not, however, concerned either with custom or with the convenience of exposition: on the contrary, it *is* the "strictly scientific" answer we want to the question: How far matter can be known apart from energy? The answer is: It cannot be known at all. I do not give this as the answer of philosophers, it is the answer of the physicists themselves. Every physical quality we distinguish, every physical change we observe, every physical measurement or comparison we can make, relates to energy, to the "life and activity" of the physical universe; not one refers to the supposed vehicle or receptacle, "the body, as it were," of that activity.

In a famous memoir on the subject, which fifty years ago was rejected as nonsense, though it has now become one of the corner-stones of the new edifice, Helm-

[1] *Properties of Matter*, p. 5.

holtz concedes this point, without, however, realizing its consequences. The point is one which, it may perhaps be thought, I have laboured sufficiently already when endeavouring to make clear the extremely abstract nature of the conception of mass. But we are approaching it now from what we might call the opposite side, and I am anxious that at every stage we should keep our authorities well in sight. Let me then quote a few sentences from the philosophical introduction, as he calls it, with which Helmholtz prefaced his essay on *The Conservation of Energy*. And please note that what primarily concerns us is the answer that his words afford to our question as to the possibility of knowing matter as distinct from energy. His philosophy of the relation of the two conceptions we can examine later. "Science," he tells us, then, "deals with external objects from two abstract points of view: first, as barely existent, apart from their effects on other objects or on our organs of sense; as such we call them matter, which for us is a thing in itself without motion, without action. Qualitative differences are not to be ascribed to it, for so soon as we speak of different kinds of matter we imply differences of operations, *i.e.* of energies. Natural objects however are not without action, for we become acquainted with them at all solely through their actions, by which they eventually affect our senses; while from these actions we infer a something acting. In applying the conception of matter, therefore, to actual things, we must restore through a second abstraction what we were previously for leaving aside, the power to produce effects; in other words, we must

assign them energy. It is manifest that, when applied to nature, the conceptions of matter and energy are not to be separated. Pure matter would for the rest of nature be a thing of indifference, since it would never determine any change either in this or in our senses. Pure energy would be something that ought to exist and yet again ought not to exist, for the existent we call matter. . . . Both conceptions are abstractions from the actual formed in the same way; we can in truth perceive matter only through its energies, never in itself."[1] Now here we have the most unequivocal admission that of matter as the simply passive vehicle or receptacle of energy we perceive nothing; that all we perceive of external objects is due wholly and solely to energy and to energy alone.

True, Helmholtz proposes to treat matter and energy as abstractions that are on the same footing; but in so doing, though—like Tait afterwards—he conforms to custom and convenience, he flies straight in the face of the strictly scientific view. No doubt we *call* matter the existent, attributing energy as a power or property to it, and attributes cannot be separated from their substances. But great as are the forces of custom and the claims of established conventions, all that the facts lead us to infer is a "something *acting*," not a something passive, which would be a thing of indifference for everything beside. To the one conception corresponds, in short, all our perceptual experience; to the other the unutterably metaphysical notion of bare existence

[1] *Ueber die Erhaltung der Kraft*, p. 4, Ostwald's Klassiker der exakten Wissenschaft. 'Kraft' translated 'energy' throughout.

per se. How then can they be both on the same footing, especially for a scientific view that discards the notion of substance as non-phenomenal and defines matter as "that which can be perceived by the senses?"[1] Energy and its transformations are given, and nothing else is given; those who wish may attach the idea of substantiality or actuality to this, but they may not multiply entities needlessly. It would seem, then, that there are *not*, after all, two classes of things in the physical universe, but one only. Such at least appears to be the logical outcome of the theory of energy.

But what of mass, it will be asked; surely mass is a property of matter, is, in fact, that very passivity which distinguishes matter from energy. To answer this we have only to ask another question: Is mass perceptible by an external sense or is it not? Now, if we turn to our text-book, Professor Tait tells us first of all that "the mass of a body is estimated by its inertia;" next that inertia "may be described as passivity or dogged perseverance" in the motor *status quo*, "familiar instances of which present themselves in all directions," as when the "sudden stopping of a train appears to urge the passengers forwards."[2] In other words, we become acquainted with inertia when we experience a change of momentum, and in no other way. But such an experience, whether we regard it as a change or as a perseverance against change, implies time and implies 'the action of natural objects.' How are we going to advance from this to mass as pure passivity, which implies neither?

[1] Thomson and Tait, *Natural Philosophy*, p. 207.

[2] *Properties of Matter*, pp. 91 f.

To that we can find no answering experience. But we have seen how theoretical mechanics by analysing the dynamical transactions in which momentum is changed has reached the two abstract conceptions of mass and force. That the latter of these terms is nothing but an analytical abstraction Professor Tait has taught us with commendable emphasis and persistence. Is it not then odd that he is so anxious to persuade us that the former is a reality? Surely here at least the two abstractions *are* on the same footing. Then must we not decline to accept masses as *things*, in which energy careers like Ariel "on the curl'd clouds"; or between which it is imprisoned, like Ariel "'twixt a cloven pine"?

All change is either a transference or a tranformation of energy — this is the new doctrine. The familiar experiences to which we owe the conception of inertia are transferences of one particular form of energy, viz., motional or kinetic energy. This energy of motion may be mathematically regarded as $\frac{\mathit{momentum} \times \mathit{velocity}}{2}$ or, as Clifford once put it, half the rate at which momentum is carried along.[1] It is now, of course, a familiar fact that other forms of energy have their *equivalents* in kinetic energy and *vice versa;* it is this fact, indeed, that renders the doctrine of energy physically so important. But it is not a fact that other forms of energy are not only quantitatively commensurable, but qualitatively identical, with energy of motion. This qualitative identity is at best but an assumption; and in the vain

[1] *Nature*, vol. xxii, p. 123.

endeavour to justify it we have seen the mechanical theory led, "to pass through the very den of the metaphysician strewed with the remains of former explorers, and abhorred by every man of science."[1]

It is this instinct of self-preservation that prompts so many physicists just now to abandon as 'foolhardy' the adventure of mechanical physics, and to set about the construction of what we might call energetical physics instead. Let me quote one of them, Professor Duhem of Lille. Referring to the mechanical method, and after illustrating its futility in chemical physics, he says:—"We have seen this method at work; we have ascertained to how small an extent experience accords with the results of its deductions. In the face of such rebuffs is it not prudent to renounce the doctrines followed thus far? Why seek by mechanical constructions to set aside bodies and their modifications, instead of taking them as our senses give them, or rather as our abstracting faculty, working on the data of sense, leads us to conceive them? . . . Why seek to figure changes of state as displacements, juxtapositions of molecules, variations of path, instead of characterising such changes of state by the disturbance introduced into the sensible and measurable properties of the body, such, *e.g.* as increase or decrease of density, absorption or evolution of heat, etc.? Why wish that the axioms on which every theory must rest should be propositions furnished by statics or dynamics, instead of accepting for principles laws founded on experience and formulated by induction, whatever be the form of such

[1] Maxwell, *Collected Papers*, ii, p. 216.

laws and whatever be the nature of the concepts to which they appeal?"[1]

Such language as a protest against the *intellectus mathematicæ permissus* sounds like the counterpart to Bacon's against the *intellectus sibi permissus*, and leads one to wonder whether, after all, one and the same infirmity will not account for both — I mean that hankering after certainty and definiteness by which we are hurried into hasty generalisations. It was this that Bacon exposed as the anticipation of nature, while ironically praising it as so much easier and more satisfying a method than the patient interpretation of nature. It was to this too that Descartes referred when he declared the will and not the intellect to be the source of errors. A mechanism may be very complex, but once get at the working drawings, and then, as Professor Hicks suggests, there are no surprises, no irregularities, no uncertainties; only master the mathematics, and you are intellectually master of the whole. That is one reason why so many "wish that the axioms on which every theory must rest should be furnished by statics or dynamics." And there is another reason still, and one to which even Descartes, in spite of all his rules, completely succumbed: I mean the influence of the imagination. We figure changes of state as being displacements or motions because we can imagine nothing else with equal clearness and distinctness. We cannot be surprised then that the certainty of mathematics, and the freedom from contradiction and obscurity of mechanical imagery, should have led so many able minds to an anticipation of nature that is

[1] *Mécanique chimique*, 1893, p. 88.

unwarranted by facts, and even induced them to affirm as Descartes, yes, and Kant too, have done, that a true science of nature extends just as far as mechanics will carry it and no farther. Time's cure for such an error is twofold: first, to leave it to work itself out and so refute itself; and secondly, to confront it with facts to which it will not apply. It was just such a conjuncture that made Bacon's denunciation of scholastic science effective. Perhaps some of you may live to see a second intellectual reformation in which the mechanical ideal of modern science will be proved in its turn to be defective and chimerical. At any rate, we have noted much that is ominous. Rigorously carried out as a theory of the real world, that ideal lands us in nihilism: all changes are motions, for motions are the only changes we can understand, and so what moves, to be understood, must itself be motion. Again, regarded as a descriptive or symbolic scheme, it proves to be only approximate and to become involved in interminable complications in the attempt to be exact. Just when scientific men, who are neither mathematicians nor physicists, Du Bois-Reymond and Huxley, for instance, are preaching "the advancing tide of matter and the tightening grasp of law," we find professed physicists renouncing their allegiance to this ancient idol. It is remarkable, too, that a change of a precisely opposite kind is going on in the more concrete sciences, which were formerly distinguished, as natural *history*, from physics, to which was reserved the title of natural *science*. Boltzmann refers to this: thus, he says: "What were formerly called the descriptive natural

sciences triumphed, when Darwin's hypothesis made it possible, not only to describe the various living forms and phenomena, but also to explain them. Strangely enough, physics made almost exactly at the same time a turn in the opposite direction,"[1] *i.e.* as I understand, abandoning the attempt to be explanatory and contenting itself with being descriptive.

But returning now to the new theory of Energy. One important point for us to take account of — let me observe once more — is that this doctrine only entitles the physicist to assert the quantitative equivalence of phenomena that are qualitatively diverse: so much energy in the form of heat is equivalent to so much energy in the form of mechanical work; or again, so much thermal or mechanical energy has its equivalent in radiant energy or in energy of electric field. But it is going altogether beyond the facts to assume that all these forms are at bottom the same, *i.e.* mechanical or kinetic. The endeavour to reduce them to one is of course legitimate and in the interests of simplification. It is, however, pure hypothesis; there is no necessity about it; and, moreover, it is a hypothesis, as we have seen, round which, in spite of all that it has accomplished, difficulties seem steadily to thicken.

There is still another point that we must not overlook, — not only are the several forms of energy qualitatively distinct, but we have, I take it, no means of knowing that all these forms have been ascertained. We have no means of ear-marking a portion of energy; and it is not necessary to know all the transformations

[1] *Methods of Theoretical Physics*, Phil. Mag. 1893, vol. xxxvi, p. 40.

and transferences that may intervene in the course of a reversible cycle before it can be said that, whatever changes energy undergoes, it is never destroyed. Indeed it would, I believe, be substantially true to say that it was by assuming the conservation of energy, while still mistaken as to the nature of heat, that Carnot laid the foundation of thermodynamics. A strict *quid pro quo* is the one thing essential. The Bank of England issues notes equivalent in value to the gold in its cellars, and pays the gold out again to whoever presents the notes, and is so far unconcerned as to all the transactions that have intervened. Whether these transactions were many or few, domestic or foreign, industrial or financial—is of no account. So here: our ignorance of one or many possible transformations does not affect the main doctrine, provided we never find a transformation in which energy appears or disappears, unaccounted for.

But it is obvious that this possibility of unknown forms of energy coupled with the probability that the known forms are not all mechanical, suggests many new vistas, for which it behoves us to keep an open mind. I shall hope to recur to this briefly in dealing with psychophysics. For the present I think we are entitled as spectators of the march of science to say at least this much: Mechanics is no longer, at the end of the nineteenth century, what she was at the beginning, when the author of the *Mécanique céleste* proposed that "jubilant toast" to her that has served as our text. Absolute supremacy is hers no more; at best she is but *prima inter pares*, and even this, not

because of the paramount value of the real knowledge she can bestow, but solely for her abstract purity of form. Should the science of energetics be destined to grow in importance at her expense, such an event would be by no means without a precedent. Think of the simplicity of the old Ionian and other pre-Socratic philosophies. Without a vestige of that knowledge that looms so large and imposing in the present concrete sciences, they set up their several ἄρχαι or first principles, water, air, fire, and so on; which now, so far from standing out as the obvious Alpha and Omega of all things, are simply lost in the multitude of particulars, quite on a par with them. And so in the history of science, do we see *axiomata media*, or middle principles, continually dwarfing and overtopping what had appeared as the veritable summits of knowledge in earlier days—such supposed summits constituting, by the way, the philosophy rather than the science of the time. And the remark is relevant, for mechanics, as I have had occasion to say before, has hardly yet ceased to count as natural philosophy, and even carries back its claims to those early times just referred to, when Democritus and Leucippus first broached the atomic theory. Its long supremacy is due largely no doubt to that vividness and mathematical accuracy with which the imagination can follow geometrical constructions. We are familiar with the influence of this fact, direct and indirect, on the minds of Plato, Descartes, Spinoza, and Kant. Had the inadequacy of the old atomism been realised earlier, the sway of the strictly mechanical theory would have

been briefer. But it was only as physics and chemistry grew that these defects of the theory of "hard, massy particles" disclosed themselves in the course of attempts to resolve physical and chemical phenomena into mechanical processes between such particles. The result, as we have seen, has been to justify Lagrange's contention that mechanics is essentially a branch of pure mathematics, and as such subservient to, not dominant over, the concrete physical sciences. These meanwhile have a new ground of unity in the doctrine of energy. The only way to a supreme generalisation concerning physical things seems to lie through this; but it is altogether premature to suppose that that generalisation will be found to consist of such a world-formula as Laplace in his enthusiasm ventured to predict.

I have said much of this projected science of energetics, but nothing as yet of its main principle, the so-called Conservation of Energy. What does this mean? Methodologically, in other words, as a formal and regulative principle, it means much; really it means very little. Those who imagine that it furnishes any basis for statements concerning the past, present, or future of the universe, as a whole, are assuredly mistaken. And there are many such. We had an instance, for example, in the passage from Du Bois-Reymond's famous Leipzig address, which I quoted in the second lecture. Referring to Laplace's imaginary intelligence, Du Bois-Reymond represents him as calculating at what moment the universe will lapse into icy chillness, its energy, though conserved, being, in accordance with the second law of thermodynamics, entirely degraded to the unavailable form of heat at one

temperature. To say nothing of the impropriety of treating the doctrine of the dissipation of energy as comparable in validity with the principle of the conservation of energy, the gratuitous assumption is here made that the quantity of energy in the universe is finite. If it should be infinite — and why should it not be? — then even Laplace's superhuman intelligence would be effectually nonplussed. But all statements concerning concrete quantity, and energy is such a quantity, imply measurement. There is but that one way of answering the question: How much? It cannot be answered *a priori* or by mere mathematics. To those who are fond of the 'high priori road' I will suggest the following consideration: If the energy of the world is a finite quantity and the second law of thermodynamics valid, how is it that the said degradation and consequent icy stillness are not the fact? For on these assumptions, such energy can only last a finite time, and the ratio of finite time to infinite duration is strictly infinitesimal. The chances then are infinity to one in favour of the universe being at any given moment 'played out.' *

But now I will venture to say that not only does the principle of the conservation of energy tell us nothing about the quantity of energy in the universe as a whole, but that it does not even allow us to say that such quantity is an amount eternally fixed. I am quite aware that Mr. Spencer may here interpose with his caveat against "pseudo-thinking," and remind us of "the experimentally established induction" that energy is indestructible. As to the first — we shall come to the second presently — I am content to make again the reply made

* See Note ix, p. 589.

when we were discussing the conservation of mass. Reality and substantiality are not identical; if energy be verily and absolutely substantial, it must no doubt be verily and absolutely permanent, neither generated nor liable to decay. But it is obvious that we cannot by observation or measurement show that this is actually the case, nor can we by *a priori* reasoning prove that it necessarily must be. It would be safe to go further, and to say that if energy were verily and absolutely the substance of things, it could not be *measured* at all. To what is absolutely substance the notion of unity and totality will apply, but these are not metrical notions. The scientific meaning of the statement, "the energy of the universe is constant," then, is not what at first blush it seems to be and is often mistaken to be. Apparently an absolute statement, it is really a relative one, and only valid as such. Apparently a statement of fact, it is really only a postulate. As with the conservation of mass, which — as we have seen — it may turn out to include, so with the conservation of energy: there are the same two grounds for making it, but neither will suffice to place it beyond question. First, it is borne out by experience, so far as we know; and secondly, it seems the simplest and best working hypothesis. As to its relativity, this it shares in common with every other empirical statement: all such tell us nothing but the ratio between the quantity measured and the quantity of the unit or standard employed in measuring. If both these quantities were to vary in the same proportion, their ratio, of course, would remain unaffected; hence it can afford no evi-

dence of such variation. We assume, however, that our standard is fixed, or what comes to the same thing *for metrical purposes* — that, if there is any variation, it is a uniform variation throughout the universe. This is all that constancy means. But a principle that will allow of such an interpretation cannot be one relating to substance.

Regarded as a postulate the conservation of energy appears under a somewhat different aspect, and one of especial interest to us. I greatly regret that there is not time enough left to deal with it more fully.* It is allowed that as an experimental generalisation the conservation of energy can only claim to be probable; on what ground then is it put forward as a fundamental principle? Helmholtz, also Thomson and Tait, found on "the axiom that the Perpetual Motion is impossible." Mayer, a genius to whom the world has yet to do justice, and even Joule, are more 'metaphysical.' Mayer falls back on the formula, *Causa æquat effectum;* and Joule declares it "manifestly absurd to suppose that the powers with which God has endowed matter can be destroyed."[1] It is clear, then, that not only are we not here in the region of experimental proof, but that no direct proof of any kind is offered us. The use of terms such as 'impossible' and 'absurd' shew plainly that any proof there is, is indirect — a sure sign that, if we are dealing with a truth at all, it is one that is self-evident. And yet it was not till the year 1775 that the French Academy of Sciences, with Lagrange and Laplace at their elbow, were so far convinced that

[1] Cf. Mach, *Popular Scientific Lectures*, p. 246.

* See Note x, p. 589.

the perpetual motion was impossible, as to decline for the future to receive any pretended demonstration of such a machine. Moreover, as Mach[1] has pointed out, the principle of virtual velocities, on which Lagrange's whole *Mécanique analytique* rests, really presupposes this axiom; yet Lagrange himself was not clearly aware of it, though sensible of the insufficiency of his proof as it stood — an insufficiency that led Poinsot to remark, that Lagrange had only lifted the clouds from the course of mechanics, because he had allowed them to gather at the very origin of that science. But after all the impossibility of perpetual motion only covers half the ground; friction and strain are absent from ideal mechanisms, so that the question what becomes of apparently wasted energy does not arise. It was the study of actual machines, with which Lagrange never troubled himself, that brought this side to the fore; and it is this, the converse of the first axiom, that Joule is attempting vaguely to establish when he says it is absurd to suppose that material powers can be destroyed. The remark is noteworthy, for it is customary to extol Joule as a sound experimentalist and to depreciate Mayer as a metaphysical dreamer. But there is little doubt that both men first of all formulated a general law, and then set to work to verify—the one by experiments, the other by computations from certain physical constants — what they had thus conceived. Mayer in a letter, quoted by Mach, says expressly: "Engaged during a sea voyage almost exclusively with the study of physiology, I discovered the new theory for the sufficient reason that I *vividly*

[1] Mach, *Lectures*, pp. 152 f.

felt the need of it."[1] But Mayer's statements are the more comprehensive inasmuch as he refers to both the creation and the annihilation of energy as impossible assumptions, summing up both in the one formula, *Causa æquat effectum.* To be sure this as it stands is too vague and perhaps too general to be impressive. More definite and workable formulations have been devised since. But the point is that, in however imperfect a form, Mayer's statement of the principle embodies all that is axiomatic in the conservation of energy, and that at bottom is none other than the principle of sufficient reason which you will remember Laplace too postulated. More precisely — since in dealing with energy, we are dealing with procession, with changes — the axiom implied is the principle of causality. These two principles of sufficient reason and causality may occupy us at some length later on. But I will anticipate to the extent of mentioning some points that will help us to round off this portion of these lectures, and bring it not merely to an end, but to some sort of conclusion.

Looked at broadly, if you will philosophically, these principles of sufficient reason and causality are part of the postulate that everything shall be intelligible and the whole of things rational. This is the *faith* of science; on this point all are agreed. Even Hume and Kant are here at one; both allow that such principles do not derive their validity from experience, though they differ widely as to what this validity is worth. The principle of causality is not a logical or a mathematical, but a real princi-

[1] Mach, p. 184.

ple; in the principle of the conservation of energy we have its aspect as quantitative applied to physical change. So we may see by the way how Lagrange as the representative of abstract mechanics failed to reach it, while Mayer, bent on rendering concrete physical facts intelligible, "vividly felt the need of it."

Though a real principle, the principle of conservation of energy renders only the quantitative relations of physical processes intelligible. What about the qualitative relations between which it determines only quantitative equality? Have we not an equal right to postulate intelligibility here too? The psychical as distinct from the physical here comes in. Action initiated by feeling is now the fundamental fact. True, we still have quantitative distinctions of a sort; that is, we have a scale of values or worth, degrees of pleasure and pain, degrees of beauty and ugliness, degrees of merit and demerit. But qualitative differences not amenable to mathematical treatment underlie them all. Motives, then, are of the nature of causes; and conduct falls within the range of the principle of sufficient reason; although in the last resort conduct carries us back to a sentient being with its pronouncement, *Sic volo, sic jubeo, stet pro ratione voluntas*. Let me recall your attention to two points in the famous pæan of Laplace: (1) his acceptance of the principle of sufficient reason as fundamental; and (2) his assumption that his imaginary intelligence "shall be acquainted with all the forces [let us say, with all the causes] by which nature is animated." If pleasure and pain can be sufficient reasons, they too must be reckoned among the causes that animate nature, or at least among

the causes that determine events. Laplace, no doubt, was careful to rule out free will; but that is not enough. Quite apart from the difficulties of that venerable problem, motives remain as a class of causes not yet admitting of mathematical treatment, still less of mechanical interpretation. *De gustibus non est disputandum* here passes from a mere maxim almost into a metaphysical principle. In other words, wherever there is feeling and preference there is something unique. Now, either this uniqueness appears in the physical world or it does not. The admission that it does will make it very difficult to stop short of regarding all the beings that compose the world — so far as 'being' implies any sort of unity or individuality — as feeling-agents, monads, or entelechies. Now, though such an admission might still leave room for an omniscient Deity, it would, it seems to me, make an end of the Laplacean physicist. Kant saw this very clearly; unhappily Clifford and other physicists, who have a predilection for 'mind-stuff,' do not seem to see it. "*Life*," says Kant, "means the capacity to act or change according to an *internal principle.* But we know of no internal activity whatever but *thought*, with what depends upon it, feeling of pleasure or pain and desire or will. But matter is *lifeless*, for on the law of inertia (next to that of the permanence of substance) the possibility of physics proper entirely depends. The opposite of this, and therefore the death of all natural philosophy, would be *Hylozoism*."[1] By the death of all natural philosophy, however, Kant means only that the

[1] *Metaphysische Anfangsgründe der Naturwissenschaft*, Hartenstein's edition, vol. iv, p. 439 f., condensed. Italics Kant's own.

mechanical theory would lose its supremacy; and that in 1786 was a thing not to be thought of. Just a century later, in 1886, we have a distinguished organic chemist, Bunge, declaring "*So treibt uns der Mechanismus der Gegenwart dem Vitalismus der Zukunft mit Sicherheit entgegen*";[1] the mechanical theories of the present are urging us surely onwards to the vitalistic theory of the future. It is mainly the tyranny of imagination that is in the way. Picture the position of Galileo, to whom the mechanical theory is primarily due, and it will be easier to believe in the Galileo that is to be.

Meanwhile, the view holds its ground that the uniqueness of feeling agents does *not* affect the physical world. To prevent "the death of all natural philosophy," it is maintained that the psychical never affects the physical sphere, the two being pronounced utterly distinct, disparate, and, so to say, incommensurable. But what if there are not two spheres; and if only one, what if the psychical is that one? However, assuming the dualism now prevalent among scientific men, according to which life and mind are merely impotent concomitants of the physical, epiphenomenal as the latest phrase is — it is difficult to see that the Laplacean physicist will be any better able than before to peer into past or future history. Grant that he knows all the changes of any brain he may select as accurately as he knows the phases of the moon. Yet he only knows them in the same way, *i.e.* as material events. As such, they afford, *ex hypothesi*, *no* clue to their mental concomitants; nay, it is of the very essence of the hypothesis that they should afford no clue.

[1] *Vitalismus und Mechanismus*, ein Vortrag., p. 20.

Such dualism, it has been said, means chopping the world in two with a hatchet. It is indeed a murderous stroke, and leaves us with two dead and impotent halves in place of the living whole. Or worse, it gives us two sets of abstractions in place of one reality. This comes out in an odd way when we compare the deliverances of many of our physiological teachers with those of foremost physicists of the Kirchhoff school. Huxley, for example, thus winds up his article on Conscious Automatism: "If these positions are well based, it follows that our mental conditions are simply the symbols in consciousness of the changes which take place automatically in the organism; and that, to take an extreme illustration, the feeling we call volition is not the cause of the voluntary act, but the symbol of the state of the brain which is the immediate cause of that act." There seems then no escape from the conclusion that the whole world is symbols. Attractions, affinities, undulations, molecules, atoms, ether, are to be regarded primarily as "mere helps or expedients to facilitate our viewing things," not as the veritable realities: so Kirchhoff or Mach. But on the other hand the 'perceptual realities,' which those physicists are content to recognise, are simply shadows and symbols: so the physiologists.

Have we no means of deciding the question at issue: Which is the real and which is the symbolic? If the question is fairly faced, it seems to me the answer is extremely easy. Roundly stated, the real is always concrete, the symbolic is always abstract. The real implies individuality more or less; the symbolic is always a logical universal. Within the range of our

experience the real implies always a history, that is, places and dates, converse with a concrete environment. The symbol is the creature of logic. If temporal and spatial relations enter into its definition or description, they are time and space coördinates with no vestige of chronology or topography about them. Now, tried by this standard, it is a glaring absurdity to call Cæsar's resolve to cross the Rubicon or Luther's to enter Worms the symbol of the dance of molecules in their brains. Yet to this pass Huxley brings himself. As I have tried to shew, and as I believe, the very advance of physics is proving the most effectual cure for this ignorant faith in matter and motion as the inmost substance rather than the most abstract symbols of the sum of existence.

And what, it may be asked, do I mean to argue from this? Simply that in our speculation about the universe we should never let go the concrete that we envisage. As long as we keep to that we find no two things absolutely alike, no two events absolutely the same. Intellectually to compass the wealth of particulars we are driven to generalise and symbolise, to employ the instrumentality of identity and uniformity among substances and causes, when the full fact is development and progress. It is far truer to say the universe is a life, than to say it is a mechanism, even such a mechanism as Goethe describes in verses that German men of science are fond of quoting, where the Spirit of the Earth "weaves at the rattling loom of the years the garment of Life which the Godhead wears." We can never get to God through a mere mechanism. I

should not like to pin my faith to Leibniz, but of all the dogmatic philosophies his seems to me — in one feature at any rate — by far the best. With him, then, I would argue that absolute passivity or inertness is not a reality, but a limit. I would not say that the atoms of our present physicists are monads, for it is still an open question if they are anything. But to whatever is entitled to be called "one of the beings composing the world," — Laplace's phrase, you will remember, — I would ascribe enough initiative and individuality to put his famed Intelligence to confusion.

PART II

THEORY OF EVOLUTION

LECTURE VII

MECHANICAL EVOLUTION

1 Mechanical evolution, *the process by which the mass and energy of the universe have passed from some assumed primeval state to that distribution which they now present. Mr. Herbert Spencer the best accredited exponent of this doctrine.*

He regards the universe as a single object, which is alternately evolved and dissolved. But the universe cannot be so regarded; and, if it could, Mr. Spencer's mechanical principles forbid such alternation. He ignores 'dissipation of energy,' and confuses energy with work. The thermodynamic zero. A finite universe must have time limits.

But is the universe finite? The Kantian antinomies and their solution. The notion of evolution not applicable to 'the totality of things.'

2 The doctrine of the dissipation of energy and questions of reversibility. *Limitations introduced by Lord Kelvin, Helmholtz and Maxwell. Two alternatives thus appear equally compatible with Mr. Spencer's 'fundamental truth.'* — (a) *evolution without guidance, and* (b) *evolution with guidance. To account for the visible universe according to* (a) *requires a definite 'primitive collocation.' This Mr. Spencer rejects; for him then the cosmos can be but a chance hit among many misses, a mere speck of order in a general chaos. In expecting more from his mechanical principles he is guilty of the fallacy of confounding* (a) *with* (b).

In resuming our discussion after so long an interval it may be well briefly to restate what it is that we have set out to discuss. Naturalism we have taken to

designate the doctrine that sets Nature in place of God, subordinates Spirit to Matter, and regards unchangeable law as supreme. It means, to quote again the words of Huxley, "the extension of the province of what we call matter and causation and the concomitant . . . banishment from all regions of human thought of what we call spirit and spontaneity . . . [till] the realm of matter and law is coextensive with knowledge, with feeling, with action."[1] This naturalistic philosophy consists in the union of three fundamental theories: (1) the theory that nature is ultimately resolvable into a single vast mechanism; (2) the theory that evolution is the working of this mechanism; and (3) the theory of psychophysical parallelism or conscious automatism, according to which theory mental phenomena occasionally accompany, but never determine, the movements and interactions of the material world. With the first of these we have already dealt, and we now come to the second, the THEORY OF EVOLUTION, in which it is applied.

Yet evolution, as commonly understood, is as far as possible from suggesting mechanism. Natural evolution or development meant primarily the gradual unfolding of a living germ from its embryonic beginning to its final and mature form. This adult form, again, was not regarded as merely the end actually reached through the successive stages of growth, but as the end aimed at and attained through the presence of some archetypal idea, entelechy, or soul, shaping the plastic material and directing the process of growth. Evolution, in short, implied ideal ends controlling physical means;

[1] Cf. Lecture I, p. 15.

in a word, was teleological. In this sense *mechanical* evolution or development becomes a contradiction in terms. Nevertheless we shall find that the category of End, equally with the categories of Substance and Cause, is nowadays outside the pale of natural science. The term 'evolution,' though retained, is retained merely to denote the process by which the mass and energy of the universe have passed from some assumed primeval state to that distribution which they have at present. Also it is implied that the process will last till some ultimate distribution is reached, whereupon a counter-process of dissolution will begin. Let us now turn to Mr. Herbert Spencer, the best accredited exponent of this doctrine, for details.

"An entire history of anything," Mr. Spencer tells us, "must include its appearance out of the imperceptible and its disappearance into the imperceptible. Be it a single object or the whole universe, any account which begins with it in a concrete form, or leaves off with it in a concrete form, is incomplete." "The sayings and doings of daily life," he continues, "imply more or less such knowledge of states which have gone before and of states which will come after. . . . This general information which all men gain concerning the past and future careers of surrounding things, Science has extended, and continues increasingly to extend. To the biography of the individual man, it adds an intra-uterine biography beginning with him as a microscopic germ; and it follows out his ultimate changes until it finds his body resolved into the gaseous products of decomposition." So as to the clothes he wears — "not stopping

short at the sheep's back and the caterpillar's cocoon, it identifies in wool and silk the nitrogenous matters absorbed by the sheep and the caterpillar from plants." So also as to "the wood from which furniture is made, [this] it again traces back to the vegetal assimilation of gases from the air and of certain minerals from the soil. And inquiring whence came the stratum of stone that was quarried to build the house, it finds that this was once a loose sediment deposited in an estuary or on the sea-bottom." In these and such like instances Mr. Spencer sees the formula of evolution and dissolution foreshadowed. To quote again his own words: "In recognising the fact that Science, tracing back the genealogies of various objects, finds their components were once in diffused states, and pursuing their histories forwards, finds diffused states will be again assumed by them, we have recognised the fact that the formula must be one comprehending the two opposite processes of concentration and diffusion. . . . The change from a diffused, imperceptible state, to a concentrated, perceptible state, is an integration of matter and concomitant dissipation of motion; and the change from a concentrated, perceptible state, to a diffused, imperceptible state, is an absorption of motion and concomitant disintegration of matter."[1]

Now, there is one obvious yet serious objection to this theory. It proposes to treat the universe, in fact requires us to treat the universe, as we treat a single object. Every single object is first evolved and then dissolved; it emerges from the imperceptible and into

[1] *First Principles*, §§ 93, 94, stereo. ed., pp. 279-281 ; rev. ed., pp. 253-256, materially altered.

the imperceptible it disappears again. And so of the universe: "Any account which begins with it in a concrete form or leaves off with it in a concrete form," Mr. Spencer tells us, "is incomplete." Surely we have here a case of what logicians call the fallacy of composition; what is predicable of the parts severally is predicated of the whole collectively. It reminds us forcibly of Locke's "poor Indian philosopher, who imagined that the earth always wanted something to bear it up." The stability of everything on the earth was manifestly due to a support, therefore the stability of the solid earth itself seemed explicable in no other manner. So the poor Indian; and similarly Mr. Herbert Spencer. As science deals with any visible, tangible thing, so the "synthetic philosophy" will deal with the totality of things. Let us take as a simple instance of the first, the familiar case suggested by Mr. Spencer himself, that of a cloud appearing when vapour drifts over a cold mountain top, and again disappearing when it moves away into the warmer air. The cloud emerges from the imperceptible as heat is dissipated and the vapour condensed, and the cloud is dissolved again as heat is absorbed and the watery particles evaporate. How shall we apply this conception or anything like it to the universe? The stronghold of Mr. Spencer's argument is the nebular hypothesis. A nebula, no doubt, is an object among other objects, though a most sublime and stupendous one. It presupposes colliding stars or meteoric swarms, whose material constituents are dissipated by the heat which their collision has produced; but then these colliding masses in their turn imply still

earlier nebulæ, whose materials concentrated as their heat diffused. So the cloud presupposed vapours that had previously condensed; and the vapour, cloud or water that had previously evaporated. And much as clouds dissolve in one place and form in another, and are to be found at any time in all possible stages of evolution and dissolution; so with sidereal systems and nebulæ. The telescope and spectroscope tell of stars and nebulæ to be found in every phase of advance or decline in every quarter of the heavens. To ask which was first, solid masses or nebulous haze, is much like asking which was first the hen or the egg, and like that famous problem, may lead us to conclude,—neither the one nor the other. Meanwhile, it does not surprise us to learn that, though Mr. Spencer is quite sure that the universe began as imperceptible mist, others, like the late Dr. Croll, who have incomparably more right to an opinion on the question, prefer to think that there was an earlier or præ-nebular stage of the universe; during which large, cold masses of protyle or primal matter were moving through space in all directions with excessive velocities.[1] Such an hypothesis, whether otherwise admissible or not, at least recognises a problem with which Mr. Spencer scarcely attempts to deal—I mean the evolution of the chemical elements. It thus suffices to convict Mr. Spencer's work of a certain incompleteness. For surely to begin with some seventy distinct forms of matter with very various and definite properties is not to begin at the beginning, however much we may imagine them to be diffused. We must return to

[1] Cf. Croll, *Stellar Evolution*, pp. 3, 109.

this question of qualitative diversity presently. But the prior question I am anxious to put as pointedly as possible is this: On what grounds is it assumed that the universe was ever evolved at all? A given man, a given nation, a given continent, a given sidereal system, as particular objects, have their several finite histories of birth and death, upheaval and subsidence, fiery mist and cold, lifeless, consolidation. But growth and decay, rise and decline, elevation and degradation, evolution and dissolution, are everywhere contemporaneous. We have but to extend our range to find a permanent totality made up of transient individuals in every stage of change. But so enlarging our horizon we are not warranted in saying, as Mr. Spencer does, "there is an *alternation* of Evolution and Dissolution in the totality of things."[1] Of the totality of things we have no experience. But now what we do find, so far as experience and observation will carry us, is that, be it great or small — once an object has disappeared into the imperceptible, once it is dissolved in Mr. Spencer's sense, that object never reappears. We do not find dead men alive again, effete civilisations rejuvenated, denuded continents again restored, or worn-out stars rekindled as of yore. *If* there were any justification for the phrase "visible universe" and *if* we could conceivably represent the totality of things as a single concrete *object*, — both which suppositions I deny, — then by all analogy and experience 'alternate eras of Evolution and Dissolution' would be infinitely improbable.[2] So surely as 'the appearance out of the imperceptible' was the beginning, so surely would

[1] *First Principles*, § 190, stereo. ed., p. 551; rev. ed., p. 506, altered.
[2] Cf. Poincaré, *Le Valeur de la Science*, 1905, pp. 182 f.

'the disappearance into the imperceptible' be the end. As, according to Mr. Spencer's own description, the entire history of anything, 'be it a single object or the whole universe,' lies completely within such limits, it is a manifest contradiction to turn round and say: After all the end is not the end and the beginning is not the beginning, and what we have called an entire and complete account of the totality of things is only one wave in an endless rhythm. It is true, of course, that the history of many concrete objects is marked by periodic phases; but never by dissolution and reëvolution, *i.e.* by the disappearance of the concrete individual followed by the reappearance of that individual — in short, by what is tantamount within the scope of such terms as visible, tangible, concrete, and perceptible — to as complete a breach of individuality as we should have in annihilation and re-creation. It is also true, as we have already noted, that *within* a given totality, one individual may succeed another, but so far that totality — the universe of discourse, so to say — remains permanent. "One generation passeth away, and another generation cometh: but the earth abideth for ever." *

Moreover, on the physical assumption from which Mr. Spencer sets out, viz. that the mass of the universe and the energy of the universe are fixed in quantity—which seems to mean are finite in quantity—there can be no such alternations as he supposes. Certainly not if we are to accept the second law of thermodynamics, the law, that is, of the dissipation of energy, along with the first law, that of the conservation of energy. But of this

* See Note i, p. 590.

second law, commonly accepted though it is by physicists at the present day, Mr. Spencer seems to take no account. Apparently, too, Mr. Spencer confuses energy or the *capacity of doing* work with work actually *done*, and imagines that so long as the quantity of energy persists, it must be manifest in perpetual changes of equivalent amount. But this in any case is not a necessary consequence of the conservation of energy, and if the dissipation of energy be true, it is an impossible consequence. For it is not on the bare persistence of energy, but on the transference and transformation of energy that physical changes depend. But energy, whatever be its form, is only transferable from places of higher 'intensity' to places of lower intensity, to use a convenient term. So we find heavy bodies tend to fall, hot bodies to cool, and so forth. Thus the amount of energy *available for work* of the total energy possessed by two bodies is a function of this difference of level or intensity, and is *nil* when this difference is *nil*, whatever the total energy may be. Generally speaking, energy is not transferred without an equivalent transformation into work; but to this rule thermal energy is an exception. And it is here that the so-called waste or dissipation of available energy comes in. Putting it quite popularly, in the partnership of energies, heat is the one squanderer, and may scatter without producing. Whenever energy passes into this form, some of it is always, and all of it is sometimes, lost for purposes of work. As Mach puts it, "heat is only partially transformed into work, but frequently work is wholly transformed into heat. Hence a tendency exists towards a diminution of the *mechanical* energy and to-

wards an increase of the *thermal* energy of the world."[1] In other words, though the energy of the world remains constant, the unavailable energy or thermal level, so to say, tends towards a maximum. There is still a peculiarity of heat to be mentioned that will make the significance of the thermal degradation of energy clearer — I refer to Lord Kelvin's definition of an absolute zero of temperature. If — whatever were the temperature of a body — we could always imagine another body with a temperature still lower, just as whatever be the position of a body we can always imagine another at a distance from it towards which it can gravitate, then, so far as in this way differences of temperature would always be possible, the transformation of heat into work might always be possible. But if there be, as is supposed, a thermodynamic zero, there is an end to such a possibility; beyond that zero temperature cannot fall. And so while all transformations of energy lead directly or indirectly to transformation into heat, from that transformation there is no complete return, and therefore finally no return at all. This then is the conclusion to which Mr. Spencer's premisses lead. Two eminent physicists who accept those premisses may be cited at this point: "It is absolutely certain," they say, "that life, so far as it is physical, depends essentially upon transformations of energy; it is also absolutely certain that age after age the possibility of such transformations is becoming less and less; and, so far as we yet know, the final state of the present universe must be an aggregation (into one mass) of all the matter it contains, *i.e.* the potential

[1] *Popular Scientific Lectures*, Eng. trans., p. 175.

energy gone, and a practically useless state of kinetic energy, *i.e.* uniform temperature throughout that mass. . . . The present visible universe began in time and will in time come to an end."[1]

Such is the conclusion to which we are led by Mr. Spencer's premisses.* But again I ask what warrant have those premisses? Our experience certainly does not embrace the totality of things, is, in fact, ridiculously far from it. We have no evidence of definite space or time limits; quite the contrary. Every advance of knowledge only opens up new vistas into a remoter past and discloses further depths of immensity teeming with worlds. The physical principles of the conservation of mass and energy are, as I have already urged, essentially formal and regulative; they do but formulate the common postulate of all science — the uniformity and continuity of nature as presupposed in all physical measurements. They do *not* justify us in assuming, what we certainly cannot prove, that the universe as a whole is measurable and therefore finite. And when we pass to more purely *a priori* considerations, the case against a universe with fixed and finite limits is equally strong. It is needless to attempt even the most cursory discussion of the antinomies as to the finitude or infinitude of the universe in respect of time, space, mass, or divisibility, that have constituted the chief cosmological problems of philosophy, notably since the time of Kant. They have only justified in the main Kant's own solution. We cannot say that the phenomenal universe is infinite in any of these aspects,

[1] *Unseen Universe*, § 115.

* See Note ii, p. 593

but just as little can we say it is finite. Since Kant's day, more cogent arguments both for the theses and for the antitheses of the cosmological problem have been advanced. None of these invalidate the claims of reason to regard the universe as a systematic whole, but they set in a stronger light than ever the impossibility of treating it as an arithmetical sum. "Say that the universe is limited," says Kant, "and it is too small for your concept; you have a perfect right to ask what determines that limit: but say that it is unlimited, and it is too large for every possible empirical concept." The reason of this is plain. In the empirical regress, to which the understanding, that is science, is entirely confined, "no experience of an absolute limit, that is, of any condition as such, which empirically is absolutely unconditional, can exist."[1] On the other hand, this regress from any given phenomenon as conditioned to another as its condition, though not truly infinite, is never suspended yet never completed; in other words, such regress must proceed *in indefinitum.*

But what Mr. Spencer calls a single object, must surely have an assignable beginning and end in time and assignable bounds in space; it is precisely through such time and space marks that the notion of singleness or identity becomes applicable. Those marks, however, are not given by empty time or space, but by other objects relatively defined in the same fashion. The universe, then, we may safely say, not only *is* not, but never can be, a single object in this wise; and Mr. Spencer's attempt to treat it after the fashion of an evolving nebula, evinces an unexpected paucity of

[1] *Critique of the Pure Reason,* 1st ed., pp. 487, 517.

imagination and is philosophically unsound. Experience provides us with instances of evolution and dissolution on the most varied scales, from the grass of the field or the cedars of Lebanon to the solar system or the Milky Way. But of a single supreme evolution embracing them all we have no title to speak: not even to assume that it is, much less to say what it is; least of all to affirm confidently that it can be embraced in such a meaningless formula as the integration of matter and the dissipation of motion — doubly meaningless unless a partial system, such as a nebula, is concerned, and even then assuming the greater portion of molecular physics without explanation. We have no evidence to shew that what we miscall the 'visible universe' is coming to an end, for we have no evidence to shew that it is finite. If we had such evidence, we should probably then and there conclude that we were dealing with but a part of the true universe and not with the totality of things. Again there is no evidence to compel the application to this absolute totality of such conceptions as increase and decrease, ebb and flow, development and decay; no physical warrant for attributing to the universe a destined perfection, that if future must either be attained and past; or approached but never completely attained at all. The former, if, as Mr. Spencer supposes, the mass and energy of the universe are finite and fundamental; the latter, if, being still the fundamental factors, the mass and energy are mathematically infinite in amount. Whether the world be absolutely perfect, or merely the best of all possible worlds, or indeed the worst world possible, as actual, it is — so

far as we can judge from its physical constitution—just what it always has been, the permanent theatre of perpetual changes.

At any rate such a conception is less conjectural and more adequate than Mr. Spencer's ridiculous comparison of the universe to a spinning top that begins by 'wabbling,' passes into a state of steady motion or *equilibrium mobile,* and finally comes to rest.* Referring to this second phase as one of perfect moving equilibrium, he finds in it "a warrant for the belief that evolution can end only in the establishment of the greatest perfection and the most complete happiness."[1] Let us not pause now to ask what sort of perfection and happiness that must be which depends on and necessarily follows from such physical equilibration: let us note only that, whatever it be, it is after all, according to Mr. Spencer, neither final nor established. It is but the "penultimate stage," as indeed he calls it, and gives place, as he tells us, to "Dissolution, which inevitably, at some time or other, undoes what Evolution has done."[2] And again I say that the absurdity to which Mr. Spencer betakes himself does not suffice to put a better face on his doctrine—the absurdity, I mean, of supposing that, though there cannot be two universes in space, there may be any number in time. Beyond the final *quietus* of cosmical equilibration the doctrine of energy, in which Mr. Spencer puts his trust, affords no hope of a new evolution. The dead bones, the black ashes, may or may not live and glow again, but if they do it will not be from the mere 'persistence of

* See Note iii, p. 593. [1] *o.c.* stereo. ed., p. 517; rev. ed., omitted.
[2] *o.c.*, § 190, stereo. ed., p. 550; rev. ed., p. 505, altered.

force' that the quickening burst will come. Why, if the thing is so obvious, not to say necessary, is it never elucidated by 'the familiar example' of the spinning top? No doubt *two* consolidated sidereal systems may diffuse again after a collision, but how is *one* to do this? And what can well be less suggestive of recurring cycles than complete concentration of mass and uniformity of temperature on the one hand and indefinite diffusion of mass and diversity of temperature on the other? It must be allowed, in so far as Mr. Spencer is personally concerned, that the doctrine of the dissipation of energy was scarcely in the air when his *First Principles* were published. Meanwhile, for us at any rate, that doctrine seems to put an end to the alternate eras of evolution and dissolution which Mr. Spencer has vainly striven to derive from the doctrine of conservation. On the whole then we may for the present reasonably demur to Mr. Spencer's attempt to bring the universe under a simple formula of evolution and dissolution, as if it were a single object emerging out of the imperceptible and dissolving into it again. Before proceeding to discuss his formula in more detail so as to ascertain its adequacy where evolution in some sense is admissible, let me first ask your attention a little longer that we may consider one or two reflexions suggested by our inquiry thus far or by points incidentally raised in the course of it.

Among the last in particular is this doctrine of the dissipation of energy, which excludes such reversibility as Mr. Spencer supposes. Lord Kelvin, who was, I believe, the first to formulate this doctrine, has been

frequently commended for the caution which led him to restrict the impossibility to cases in which the agency of inanimate matter is alone concerned. Thus Helmholtz, referring to this reversion in a review of Lord Kelvin's papers, says: "Such a reversion is a postulate beyond the power of human means to fulfil. We have no agency at our disposal by which to regulate the movement of atoms. Whether, however, in the extraordinarily fine structure of organic tissues a mechanism capable of doing it exists or not is a question not yet to be answered, and I deem it very wise on the part of Sir W. Thomson that he has limited all his theses respecting the necessity of increasing dissipation by restricting their validity to 'inanimate matter.'"[1] Dissipation of energy Lord Kelvin himself tells us, "follows in nature from the fortuitous concourse of atoms. The lost motivity is essentially not restorable otherwise than by an agency dealing with individual atoms; and the mode of dealing with the atoms to restore motivity is essentially a process of assortment, sending this way all of one kind or class, that way all of another kind or class."[2] Many here will remember a fine passage in Mill's *Political Economy* on the function of labour, in which he shews with impressive detail that in what is called the action of man upon nature it is "the properties of matter that do all the work, when once objects are put into the right position. This one operation of putting things into fit places for being acted upon by their own internal forces, and

[1] *Wissenschaftliche Abhandlungen*, Bd. iii, p. 594.
[2] *Properties of Matter*, p. 139.

by those residing in other natural objects, is all that man does, or can do, with matter. He only moves one thing to or from another:" all his vast command over natural forces immeasurably more powerful than himself "is obtained by arranging objects in those mixtures and combinations by which natural forces are generated, as when by putting a lighted match to fuel, and water into a boiler over it, he generates the expansive force of steam, which has been made so largely available for the attainment of human purposes."[1] Here then we have the materials and powers of nature, as they fortuitously occur, incapable of, and unavailable for, results, to which nevertheless they can be guided by intelligent assortment and arrangement. And in a precisely analogous way we can imagine finite intelligences disequalising temperature and undoing the natural diffusion of heat, or assorting atoms and undoing the natural conglomeration of matter, and so reversing the downward trend, and even disturbing the final quiescence, to which the dissipation of energy or 'cosmic equilibration,' to use Mr. Spencer's term, inevitably leads. The conception of such an intelligence we have in "the sorting demon of Maxwell," as Lord Kelvin has called it.

This brilliant idea was devised by Maxwell primarily to illustrate "the limitation of the second law of thermodynamics," to shew, that is, that this second law, the law of the degradation of energy is not like the first—the law of conservation—a fundamental, dynamical law; that,

[1] *Principles of Political Economy*, Bk. i, chap. i, § 2. Mill attributes this observation to his father, but even he was anticipated by Bacon (*Novum Organum*, lib. i, Aph. 4), and again by Playfair.

on the contrary, it is properly a statistical law and confined to our experience of secondary bodies consisting of an immense number of molecules, none of which are individually perceptible. And so he remarks: "This law is undoubtedly true as long as we can deal with bodies only in mass, and have no power of perceiving or handling the separate molecules of which they are made up. But if we conceive a being," — and here we are introduced to the 'sorting demon' — "whose faculties are so sharpened that he can follow every molecule in its course, such a being, whose attributes are still as essentially finite as our own, would be able to do what is at present impossible to us." To most of you I am sure the *modus operandi* of this possible but imaginary being is perfectly well known; still, to add to the clearness of our discussion, I will venture to quote the rest of Maxwell's paragraph. "For we have seen," he continues, "that the molecules in a vessel full of air at uniform temperature are moving with velocities by no means uniform, though the mean velocity of any great number of them, arbitrarily selected, is almost exactly uniform. Now let us suppose that such a vessel is divided into two portions, A and B, by a division in which there is a small hole, and that a being, who can see the individual molecules, opens and closes this hole, so as to allow only the swifter molecules to pass from A to B, and only the slower ones to pass from B to A. He will thus, without expenditure of work, raise the temperature of B and lower that of A, in contradiction to the second law of thermodynamics." [1]

[1] *Theory of Heat*, 1894, pp. 338 f.

Now, what I think we may fairly deduce from this piece of physical exposition is that conservation of energy at any rate, — and this is Mr. Spencer's one dynamical principle, — is compatible with either of two alternatives.[1] The first is that steady fall in the level of available energy, which finds expression in the second law of thermodynamics, technically given in the statements of Lord Kelvin and Clausius already referred to,[2] viz., that, though the energy of the universe remains constant, the entropy of the universe tends towards a maximum.[3] The second alternative is the process of assortment and guidance — without expenditure of work — by a selecting and directing intelligence, which process may, to an indefinite extent, reverse and overrule the dissipation of energy, that tendency merely to run down. For, granting the energy of a material system, however large, to remain constant, and granting change of direction without work to be always theoretically possible, we may infer that, even after the physically final state of complete dissipation was reached, intelligent beings would still be able without infringing any dynamical principles to render its dissipated energy again available, and for an adequate intelligence to start the whole system anew on a fresh round of evolution. This is forcibly put in the paper of Helmholtz's, from which I have already quoted: "The ascertained laws of dynamics," he says,

[1] But our difficulties, no doubt, increase when we take into account other dynamical principles which Mr. Spencer neglects. Cf. below, Lecture XII.

[2] Cf. above, p. 194.

[3] Strictly speaking, we are not warranted in applying metrical motions to the universe. Cf. pp. 87, 171.

"yield the deduction that, if we were able suddenly to reverse the total movements of the total atoms of an isolated mechanical system, the whole system would of necessity retraverse all the states which up to that point of time it had passed through. Therewith, also, would all the heat, generated by friction, collision, conduction of electrical currents, etc., return into other forms of energy, and the energy, which had been dissipated, would be all recovered."[1] And I presume that an intelligence that could precisely reverse the directions could alter them as easily in other ways. But the point is that, apart from intelligent guidance and arrangement, no such recovery or alteration would be possible.

It will be quite worth while to compare these alternatives somewhat further. Though both are equally compatible with the persistence of energy, yet Mr. Spencer, as we have seen, admits only one, and ignores the fact that that one entirely precludes such alternations of evolution and dissolution as he assumes. According to that, which we may fairly call the mechanical view, evolution, or rather, as Mr. Spencer ought to say, a given era of evolution, begins at an initial extreme, characterized by him as an imperceptible state of absorption of motion and concomitant disintegration of matter; and ends with a final extreme, equally imperceptible, of integration of matter and concomitant dissipation of motion. In conciser and more intelligible language, the whole process ranges from an extreme of exclusively potential energy to an extreme in which all available energy is dissipated. The other

[1] *Wissenschaftliche Abhandlungen*, Bd. iii, p. 594.

alternative, which we may perhaps call the teleological view, neither requires such an initial stage—if that have any meaning—in order that evolution may begin, nor is debarred by the dissipation of energy from all possibility of further change. Without postulating the creation of energy it recognises the control of energy by intelligence. Under what circumstances and by what means such intelligent guidance is effected we need not now inquire; it is allowed to be possible, and for the present that is enough.

And now let us attend to the important difference between these two views,—evolution without guidance, and evolution with guidance. According to the former, the entire course of things is once and for all determined singly and solely by the initial distribution. It is here that the Laplacean calculator comes in, prepared from the mechanical data of any one moment to find the state of the whole world at any other. For there is one, and only one, course that a system of inert matter will pursue without guidance,—the line of least resistance: it will run down, and it will run down by the easiest and shortest way. But the directions that such a system may be led to take under guidance, but still conformably to the law of conservation, may be innumerable. To forecast the actual progress on this view it is useless to know merely what would happen in accordance with mechanical laws, if the system were left to itself: for any forecast in this case a knowledge of the end or meaning of such progress would be indispensable. Let us take one or two familiar instances by way of illustrating the difference. Imagine a derelict

ship and a sea-worthy vessel fully manned: if you know enough of the winds, tides, and currents, you can say where the derelict is likely to be after a week's interval, but this information will be but of secondary importance if you should attempt to predict the position a week later of the ship under sailing orders. Take two trains running opposite ways on a single line of rails,—of which there are hundreds in this country every day: if you know their distance apart, their rates, and that they are left to themselves, you can calculate when and where they will collide. Yet the extreme rarity of collisions is secured simply by what is practically "guidance without work," by 'pointsmen' directing energy which in itself is directionless.

But however impressive the difference between these two forms of process, the blindly mechanical and the intelligently guided, and however surely common sense in our ordinary affairs enables us to distinguish between the two, yet in so far as both are compatible with mechanical principles it is obvious that strictly mechanical considerations will not enable us to distinguish between them. A bullet aimed to hit the mark conforms to the law of projectiles as completely as one fired at random. But now, of a thousand bullets so fired haphazard, probably one or more will hit equally truly. This simple instance may serve to characterise two ways in which the teleological aspect of things can be viewed mechanically. The first is by way of primitive collocations. As the marksman's aim determined the initial movement of the bullet with a view to its final impact on the bull's-eye, so the Creator chose that

particular configuration of nebulous matter from which the existing cosmos would mechanically ensue. So Whewell, Chalmers, Jevons, and others represent the beginning of evolution. "Out of infinitely infinite choices which were open to the Creator, that one choice must have been made which has yielded the Universe as it now exists," says Jevons. We may venture, I think, to call this a short-sighted and fatalistic view; but I am quite aware that those who first propounded it had many qualifications in reserve, qualifications, however, which must logically resolve the external Artificer into an immanent Spirit. But at all events this half-way house, whatever it be worth, is closed against Mr. Spencer, if even he were disposed to occupy it. For him there can be no 'ultimate properties of kinds,' and no specific collocation of diverse natural agents. Thoroughgoing homogeneity, diffusion, and imperceptibility, are, as we shall see presently, incompatible with such variety in the positions and mechanical endowment of the primitive particles as Jevons, for example, supposes. To Mr. Spencer there is open only the second way of one chance hit out of many misses. We have all of us to admit that facts are by no means wanting that may seem to justify such a view of Nature at least in details, as when finding, for example, "that of fifty seeds, she often brings but one to bear." For the mechanical theory of evolution, however, this second way is absolute and universal. But it will be best here to cite Mr. Spencer's own words: "We have to contemplate the matter of an evolving aggregate as undergoing not progressive

integration simply, but as simultaneously undergoing various secondary redistributions; we have also to contemplate the motion of an evolving aggregate, not only as being gradually dissipated, but as passing through many secondary redistributions on the way towards dissipation."[1] Such is Mr. Spencer's general summary; but it would be useless, I fear, to attempt to quote also any of the numerous instances even of physical phenomena, to say nothing of phenomena of a higher order, which he has gathered together in such impressive and bewildering variety in order to substantiate it. I can put the case best, as I understand it, by taking an illustrative instance of my own. Imagine a single drop of water falling alone over Niagara: it will go with accelerated velocity straight from top to bottom. Such a process may typify simple evolution. Now try to realise what happens when the full volume of the river pitches at once over the Falls. The end is in the main the same as before, but in the course of simple evolution on this larger scale there occur many, and some very striking, instances of compound evolution, in other words, of redistributions, arrests, and reversals of the main process. Individual drops and groups of drops may dash each other into mist, fall, rise, and fall again, eventually joining the stream below only after a long time and by the most devious routes. Imagine the height of the Falls and so the time of falling to be vastly increased, and the secondary results will be more varied still. To this head of compound evolution, then, we are asked to refer all the complex-

[1] *First Principles*, § 145, stereo. ed., p. 396; rev. ed., p. 367, omitted.

ity of structure and movement, all the varieties of form and rhythm, of which the actual world consists. "Hence," says Mr. Spencer, "other things being equal, in proportion to the quantity of motion which an aggregate contains will be the quantity of secondary change in the arrangement of its parts that accompanies the primary change in their arrangement. Hence, also, other things equal, in proportion to the time during which the internal motion is retained, will be the quantity of this secondary redistribution that accompanies the primary distribution."[1] A little reflection will shew, I think, that on this doctrine what others secure by primitive collocations is secured by taking things on a sufficiently large scale, and trusting to the combinations which haphazard will give. Shuffle an adequate number of fonts of type long enough and a given play of Shakespeare will be among the throws; for it is a possible combination, and in time all possible combinations may be expected. In fact, Mr. Spencer's law of evolution seems to consist essentially in treating the universe as a vast problem in thermodynamics, so to speak.

Apropos of this I cannot do better than quote a striking passage from a letter of Boltzmann's that appeared in *Nature* about a year ago: "We assume that the whole universe is, and rests forever, in thermal equilibrium. The probability that one (only one) part of the universe is in a certain state, is the smaller the farther this state is from thermal equilibrium; but [on the other hand] this probability is greater, the greater is

[1] *Ibid.*, § 99, stereo. ed., p. 289 ; rev. ed., p. 264.

the universe itself. If we assume the universe great enough, we can make the probability of one relatively small part being in any given state (however far from the state of thermal equilibrium) as great as we please. We can also make the probability great that, though the whole universe is in thermal equilibrium, our world is in its present state. It may be said that the world is so far from thermal equilibrium that we cannot imagine the improbability of such a state. But can we imagine, on the other side, how small a part of the whole universe this world is? Assuming the universe great enough, the probability that such a small part of it as our world should be in its present state, is no longer small. If this assumption were correct, our world would return more and more to thermal equilibrium; but, because the whole universe is so great, it might be probable that at some future time some other world might deviate as far from thermal equilibrium as our world does at present."[1]

By 'world' I take Boltzmann to mean what is commonly called the 'visible universe' or 'our galaxy.' The return to thermal equilibrium again corresponds to Mr. Spencer's simple evolution, assuming a like fortuitous initial distribution or absence of specific collocations, and a universe indefinitely great. Of course there is no lack of space and time; even energy too is cheap, when you have only to imagine it. But such a chance oasis of life and order in an illimitable desert of monotonous irregularity is, I need hardly say, *not* what Mr. Spencer means by evolution. So much the worse,

[1] *Nature*, 1894-1895, vol. li, p. 415.

however, for his synthetic philosophy. For while that is the most that his law entitles him to, he assumes not merely that the present throw — to recur to my illustration — is comparable to a play of Shakespeare, but he assumes also that, after the processes of dissolution shall have broken up the type, another play will be thrown next time. In other words, he is guilty of the amazing fallacy of supposing that, because the laws of energy are everywhere present, they are everywhere sufficient to explain what we see; which is much the same as assuming that, because a painter's palette, like his finished canvas, shews us a mixture of colours laid on with a brush, therefore what sufficed to produce the one would equally suffice to produce the other.

But the further exposure of this prime fallacy of Mr. Spencer's synthetic philosophy must be reserved till next lecture.

LECTURE VIII

MR. SPENCER'S INTERPRETATION OF EVOLUTION

Mr. Spencer proposes to deduce the phenomena of evolution (celestial, organic, social, etc.) from the conservation of energy. The obvious insufficiency of this principle taken alone. Mr. Spencer's conception of it contrasted with that of Helmholtz.

How Mr. Spencer connects this 'persistence of force,' as he prefers to call it, with his doctrine of the Absolute. The vagueness of his terms.

The three principles in Mr. Spencer's interpretation: 1. Instability of the homogeneous. *But is the homogeneous necessarily unstable? Quite the contrary. Moreover, Mr. Spencer cannot by analysis get at such a beginning as he supposes. How much can evolution possibly account for, and how little need it presuppose? No clear advance to be made from Mr. Spencer's standpoint. Some illustrative instances of Mr. Spencer's procedure:* (a) *self-rotating nebulæ: in a single homogeneous object no ground of change;* (b) *instability of circular orbits: looseness of Mr. Spencer's terminology;* (c) *chemical differentiation, instability of the* heterogeneous: *two-edged arguments.*

2. Multiplication of effects. *An instance of what Mr. Spencer understands by one cause and many effects. Illusory deduction of this principle from the fundamental one of persistence of force.*

3. Segregation. *This 'the key to the advance from vague chaotic heterogeneity to orderly heterogeneity.' The process described: it turns out to require only 'forces acting indiscriminately.' Relation of this principle to the other two. Difficulties for Mr. Spencer in connection with the distribution of the chemical elements. Also in the characteristics of organisms and the products of human industry. But Mr. Spencer's terminology is happily 'plastic.'*

As we shall have to refer frequently to Mr. Spencer's formula of evolution in its final form, I will begin by

quoting it at length: "*Evolution is an integration of matter and concomitant dissipation of motion* [so much answers to 'simple evolution' and has been dealt with already; what follows includes 'compound evolution'] *during which the matter passes from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity; and during which the retained motion undergoes a parallel transformation.*" [1]

"The task before us," says Mr. Spencer, the law of evolution being ascertained, "is that of exhibiting the phenomena of Evolution in synthetic order. Setting out from an established ultimate principle, it has to be shown that the course of transformation among all kinds of existences cannot but be that which we have seen it to be. It has to be shown that the redistribution of matter and motion must everywhere take place in those ways and produce those traits, which celestial bodies, organisms, societies, alike display. And it has to be shown [here is the point] that this universality of process results from the same necessity which determines each simplest movement around us, down to the accelerated fall of a stone or the recurrent beat of a harp-string. In other words, the phenomena of Evolution have to be deduced from the Persistence of Force. As before said—'to this an ultimate analysis brings us down; and on this a rational synthesis must build up.'" [2]

By Force Mr. Spencer means, among other things, Energy. Now I think it is quite clear that, so far from accounting for all the phenomena of evolution,

[1] *First Principles*, § 145, stereo. ed., p. 396; rev. ed., p. 367, altered.
[2] *o.c.*, § 147, stereo. ed., p. 398; rev. ed., p. 369.

the doctrine of the persistence of energy alone will not account for a single one. The celestial, organic, social, and other phenomena which make up what Mr. Spencer calls cosmic evolution are so many series of qualitative changes. But the conservation of energy is not a law of change, still less a law of qualities. It does not initiate events, and furnishes absolutely no clue to qualitative diversity. It is entirely a quantitative law. When energy is transformed, there is precise equivalence between the new form and the old; but of the circumstances determining transformation and of the possible kinds of transformation the principle tells us nothing. If energy is transferred, then the system doing work loses precisely what some other part of the universe gains; but again the principle tells us nothing of the conditions of such transferences.

As I tried to shew briefly in the sixth of these lectures, this principle may be regarded as primarily and fundamentally *a priori*. Somewhere or other we postulate persistence or conservation, and finding so far as experience goes that mass and energy are conserved, we apply to them this *a priori* postulate. It might turn out that we were wrong in this application, but the postulate in its abstract generality we should still not question. In some sense it must be true to say *Causa æquat effectum*, and meanwhile there is a vast body of evidence to shew that it is true of the transferences and transformations of energy. But now the fact that the principle of energy involves in this wise both an *a priori* and an empirical factor is continually ignored by Mr. Spencer. He lays all the stress on the

a priori factor, *i.e.* on his own extraordinary version of it; and does not see that this by itself is ludicrously insufficient. Hence such language as this, with which his chapter on the Persistence of Force concludes: "Deeper than demonstration—deeper even than definite cognition—deep as the very nature of mind, is the postulate at which we have arrived. Its authority transcends all other whatever; for not only is it given in the constitution of our own consciousness, but it is impossible to imagine a consciousness so constituted as not to give it."[1] And now let me quote for comparison with this a sentence or two from the conclusion of Helmholtz's famous essay on the same subject: "I believe that what has been here advanced has shewn this law to be contradicted by no facts at present known to science, but to be strikingly confirmed by a very large number. I have striven to exhibit as completely as possible such consequences as follow from it in combination with the laws of natural phenomena so far ascertained, consequences which must still await experimental verification. It has been my aim to lay before physicists with all possible completeness the theoretical, practical, and heuristic importance of this law, the complete establishment of which may well be regarded as one of the chief undertakings of the immediate future."[2] Such language as this would be not only sheer nonsense, but a sheer impossibility if Mr. Spencer's philosophy were right. Clearly Helmholtz does not regard the persistence of force as a

[1] *First Principles*, § 62, stereo. ed., p. 192; omitted in rev. ed.

[2] *Erhaltung der Kraft*, Ostwald's edition, p. 53.

datum of consciousness. But now Mr. Spencer, in a very solemn passage, declares that "if it can be shewn that the persistence of force is not a datum of consciousness; or if, etc.," why, "then, indeed," he adds, "it will be shewn that the theory of Evolution has not the high warrant here claimed for it."[1] The burden of proof, however, plainly lies with him. Here is a principle, of which physicists fifty years ago were unaware, a principle which has had to fight its way to recognition, a principle the range of which is still a question — the notion of dynamically non-conservative systems being therefore not absurd; if this principle lies so wondrous deep, "deeper than demonstration, deeper even than definite cognition," then let Mr. Spencer explain Newton's ignorance of it and the general scepticism that greeted its enunciation by Mayer, Joule, and Helmholtz. Perhaps the terrible depth from which they must have brought it is the explanation!

Taking this principle, then, as physicists understand it, and not as it is misunderstood by Mr. Spencer, I repeat that it will not carry us one step towards his evolutionary formula. You could not deduce from it even those "simplest movements," "the accelerated fall of a stone or the recurrent beat of a harp-string," which he assumes to be necessarily determined by it. Yet still more hopeless, if possible, would it be to find for "the theory of evolution the high warrant claimed for it" if we took Mr. Spencer's own version of the persistence of force instead of the accepted doctrine.

To examine this version must appear, I fear, some-

[1] *First Principles*, § 192, stereo. ed., p. 553; rev. ed., p. 508.

what of a digression. But let me remind you how often this recognised champion of naturalistic evolution reiterates his confidence that nothing short of a refutation of this ultimate position can shake his general conclusions: "to this," he has said, "an ultimate analysis brings us down and on this a rational synthesis must build up." "But now what is the force of which we predicate persistence?" asks Mr. Spencer; and he answers: "It is not the force we are immediately conscious of in our own muscular efforts . . . the force of which we assert persistence is that Absolute Force, of which we are indefinitely conscious. . . . By the persistence of Force [capital F], we really mean the persistence of some Power [capital P] which transcends our knowledge and conception. The manifestations, as recurring either in ourselves or outside of us, do not persist; but that which persists is the Unknown Cause [capitals again] of these manifestations."[1] * In this statement it is important to note two things. First, that between the manifestations or phenomenal forces, according to the usual phrase, and this 'Absolute Force' or Power, there stretches all that gulf, which Mr. Spencer has elsewhere magnified, separating the known and comprehensible from the unknown and incomprehensible. Secondly, that by persistence as applied to phenomenal forces he means the quantitative constancy of these in their totality; while by persistence as applied to Absolute Force he means, as he says, to assert "an Unconditioned Reality, without beginning or end." Now, if Mr. Spencer's cosmic philosophy does not fall between

[1] *Ibid.*, § 60, stereo. ed., p. 189; rev. ed., § 62, p. 175, very much altered.

* See Note iv, p. 594.

these two supports or lose itself in that 'ugly, broad ditch' Schelling spoke of, between Nature and the Absolute, it will be luckier than most eclectic attempts. If it had started from the Absolute and Unconditioned Reality, of which we are said to be indefinitely conscious, it would obviously have been gratuitous — nay, self-contradictory and nonsensical — to assume that the manifestations of this Unknowable to finite intelligences must remain always quantitatively the same. If "rational synthesis" of things is what we seek, it is surely more reasonable to say with Lotze: "What lies beneath all is not a quantity which is bound eternally to the same limits and compelled through many diverse arrangements, continuously varied, to manifest always the very same total. On the contrary, should the self-realisation of the Idea require it, there is nothing to hinder the working elements of the world being at one period more numerous and yet more intense; at another period less intense as well as fewer. Then would the course of Nature be like a melody, not flowing in monotonous uniformity, but with *crescendos* and *diminuendos* as each in turn is required to express the meaning of the whole."[1]

If now, on the other hand, Mr. Spencer had started from the phenomenal, then, allowing as he does, that of the conservation of energy neither inductive proof nor demonstration is possible, he ought to have regarded that law as, like the still wider law of causation, a postulate or regulative principle connecting together the various branches of physics. But a basis so tenta-

[1] *Metaphysik*, 1879, § 209. See Note v, p. 595.

tive and restricted would not suffice for a theory which essays to exhibit all the changes of celestial bodies, organisms, and societies as necessary results of the same universal principle. "The recognition of a persistent Force, ever changing its manifestations but unchanged in quantity throughout all past time and all future time, is," he declares, "that which alone makes possible each concrete interpretation and at last unifies all concrete interpretations."[1] So he is led to perpetrate two or three astounding feats of philosophical jugglery. The apparatus of the first of these we have now before us. Persistence in the sense of *permanence* is secured first of all by reference to the Unconditioned Reality; the non-existence of which is unthinkable, although any knowledge of it is impossible—since to know is to condition. Next persistence—but now in the sense of *quantitative constancy*—is transferred from this Unconditioned Reality to its phenomenal manifestations; only, however, by first affirming of it precisely the statement that we are not empirically warranted in precisely affirming of them. Let me present this apparatus anew in Mr. Spencer's own words. *Item No.* 1. "Getting rid of all complications and contemplating pure Force, we are irresistibly compelled by the relativity of our thought, to vaguely conceive some unknown force as the correlative of the known force."[2] *Item No.* 2. "Every antecedent mode of the Unknowable must have an invariable connexion, quantitative and qualitative, with that mode of the Unknowable which we call its consequent. For to say otherwise is to deny the per-

[1] *First Principles*, § 191, stereo. ed., p. 552; rev. ed., p. 507.

[2] *o.c.*, § 50, stereo. ed., p. 170; rev. ed., omitted.

sistence of force."[1] *Item No.* 3. "For persistence is nothing more than continued existence, and existence cannot be thought of as other than continued."[2] In the first we get the absolute existence of Force, with a capital F, at the price of absolute ignorance concerning it; in the second, we get the absolute constancy of force, with a little f, at the price of making precise and definite statements concerning that Unknowable. The intellectual somersault thus rapidly performed is covered by taking continued existence to involve invariable quantity. How quantity of Unconditioned and Unknowable Reality is to be measured we are not told, nor yet what the unit of measure is to be. Does not this step deserve the name of intellectual jugglery: on two items of ignorance to establish an ultimate principle determining what the course of transformation among all kinds of existences must be? We do not *know* what the Absolute is and we cannot *prove* that the quantity of force remains always the same. But since no consciousness can think being as not being, the persistence of the persistent is the fundamental cognition from which all others are derived; hence the Unknowable in persisting must make the knowable that does not persist a constant quantity.

By such fetches of ingenuity to resolve the Absolute into a fixed quantity would, after all, not be worth the pains, unless, as I have said, force is to have a much wider meaning and the conservation of energy a much wider range than science at present allows to them. Otherwise it would be impossible to bring organisms

[1] *First Principles*, § 63, stereo. ed., p. 193; rev. ed., p. 177.
[2] *o.c.*, § 65, stereo. ed., p. 195; rev. ed., omitted.

and societies and all thereto pertaining — life, mind, character, language, literature, and institutions of every kind — under the cover of a single formula. We are therefore not surprised to find Mr. Spencer treating of the transformation of physical forces into mental forces and insisting on a quantitative equivalence between the two, just as he treats of the transformation of mechanical work into heat and the value in foot-pounds of a calorie. The poetry of Milton and the British Constitution, nay, the human mind and the Christian religion, are all according to him, equally with the tidal bore on the Severn or gales at the equinoxes, so many secondary results of the nebular hypothesis, cases of integration of matter and dissipation of motion in obedience to the persistence of force. It is to encompass all these within one formula that he is tempted to stretch a great physical generalisation beyond all meaning, and to justify his venture by questionable metaphysics concerning Absolute Being. But it will be time enough to deal with the hopeless vagueness of Mr. Spencer's conceptions of "knowable force" as cases arise. Meanwhile, having seen how little he succeeds in obtaining for his theory of evolution the high warrant he claims for it, let us turn to some of the details of the theory itself.

At once we make a great descent. We leave behind the Ultimate Cause, Inscrutable Power, Unconditioned Reality, supposed to be indispensable to Mr. Spencer's "rational synthesis." We now find ourselves confronted, as the complete theory requires, by the whole universe in "a diffused imperceptible state." "On setting out," says our guide, "the proposition which comes

first in logical order, is that some rearrangement must result: and this proposition may best be dealt with under the more specific shape that the condition of homogeneity is a condition of unstable equilibrium." Or more precisely: "The absolutely homogeneous must lose its equilibrium, and the relatively homogeneous must lapse into the relatively less homogeneous."[1] * But this is going too fast. *Il n'y a que le premier pas qui coûte:* so we must be wary here. That homogeneity implies instability is anything but self-evident. For one thing, if such were the case, it would be difficult to see how, on Mr. Spencer's theory, such homogeneity could ever arise. Any given era of evolution we are free to regard, according to his principles, as preceded by an era of dissolution, the persistence of force being supreme throughout. We seem required to picture the whole universe, as soon as evolution is complete, beginning to decompose and continuing so to do in such a manner that the state of homogeneity shall be simultaneously reached by every part of it. Otherwise, owing to the instability of the homogeneous, the counter-process of redintegration would begin in one part before the others were ready. There seems, however, but one way in which such a simultaneous dissolution is possible, viz.: by the precise and instantaneous reversal of every movement throughout the whole, as stated, *e.g.*, in the passage from Helmholtz quoted in the last lecture. The universe would then be like a reversible musical box which could play its tunes backwards; and, assuming it to have started from a homogeneous state, it would in

[1] *First Principles*, §§ 149, 155, stereo. ed., pp. 400, 429; rev. ed., pp. 372, 397, altered.

* See Note vi, p. 595.

this way return to it. But this is not what Mr. Spencer understands by dissolution.

Homogeneity is not necessarily instability. Quite otherwise. If the homogeneity were absolute,—that of Lord Kelvin's primordial medium, say,—then the stability would be absolute too. In other words, if "the indefinite, incoherent homogeneity," in which, according to Mr. Spencer, some rearrangement *must result*, were a state devoid of all qualitative diversity and predicable of the universe, then, as we saw[1] in discussing mechanical ideals, any "rearrangement" could result only from external interference; it could not begin from within. All physicists are agreed, as Messrs. Tait and Stewart put it, that "in the production of the atom from a perfect fluid, we are driven at once to the unconditioned—to the Great First Cause; it is, in fine, an act of creation and not of development."[2] Thus, the very first step in Mr. Spencer's evolution seems to necessitate a breach of continuity. This fatal defect is not apparent in his exposition; but only because, as remarked in the last lecture, the whole vast problem of molecular development is lost in the haziness of the nebular theory; and, further, as we now see, is slurred over by the vagueness of such a term as "indefinite, incoherent homogeneity."

Mr. Spencer's attempt to evolve the chemical elements from prime atoms by means of the nebular hypothesis has, I believe, impressed nobody—unless it be with his failure to realise the endless complications with which such a problem is beset. But suppose this stage of evolution satisfactorily explained, still what of the prime

[1] Cf. pp. 133 f. above. [2] *Unseen Universe*, 2nd ed., p. 117.

atom? Are we to call that indefinite, incoherent, homogeneous? How can an atom be indefinite or incoherent? How, then, if we are to begin with the indefinite and incoherent, can we begin with an atom of any sort? And if we go beyond atoms to some cosmic protyle such as that of Sir William Crookes, must we not assume, too, as he suggests, that this "elementary *protyle* contains within itself the potentiality of every possible combining proportion or atomic weight,"[1] and then how can it be homogeneous? There is, however, no end to such questions. At any rate our reflections on the kinetic ideal of matter brought us, it may be remembered, to this conclusion.

That conclusion suggests two or three further remarks on Mr. Spencer's "interpretation of evolution." In the first place, the synthetic philosophy cannot begin at the beginning of evolution because physical analysis can never place it there. Such conceptions as prime atoms, primordial media, *prima materia*, and the like, are obviously ideal limits and not possibly presentable realities. In the next place, such limiting conceptions, taken alone and treated as realities, lead straightway to absurdities. We cannot begin operating with zeros and infinities, though we recognise quantities that approximate to them asymptotically. So, in like manner, qualitative diversity may be replaced by quantitative formulæ and the range of mathematical description extended without assignable limit. But such procedure is plainly one of abstraction, and — if carried to the uttermost — leaves us, as we saw, with absolutely no real content to

[1] Address at Brit. Assn., 1886, *Nature*, vol. xxxiv, p. 428.

which our numbers and diagrams apply. A real world is sublimated into "non-matter in motion." To such epistemological reflections our synthetic philosopher seems altogether a stranger, or he could never have perpetrated the transparent absurdity, doubly an absurdity in his case, of representing any heterogeneity as arising simply—provided only there is quantitative equivalence—out of absolute homogeneity. Such homogeneity is essentially stable; and thus the first step in his scheme of evolution becomes impossible, because, in his zeal to be thorough, our author has eliminated all ground of difference. Or if he has not, he has failed to make good his undertaking, and begins not at the beginning, but with atoms having indefinitely many potentialities and distributed according to some specific configuration; in other words, begins with the manufactured articles of Herschel and Maxwell, and the collocations of Chalmers and Mill. In point of fact he begins, as said, with the 'nebular hypothesis,' all that goes before it being adroitly covered by the utterly unscientific and unphilosophical phrase 'indefinite incoherent homogeneity.'

One further remark before we proceed; the proposal to start with complete homogeneity leads us to ask: How much can evolution possibly account for, and how little need it presuppose? According to Mr. Spencer's drift, it would seem that evolution, expounded in thorough, philosophical fashion, will account for all form, provided only a fixed quantity of matter and energy is given. As Professor Riehl humorously puts it: "Listen to Herbert Spencer and you must believe that liter-

ally everything there is has evolved, including forsooth even evolution itself."[1] But so long as we look at things from a purely mechanical standpoint, as Mr. Spencer does, it is difficult to see what ground there is for asserting any increase of complexity at all. Given a certain aggregate of mass-points regarded as a conservative system, then there will be a certain number of possible configurations through which it can pass; but on what grounds, I would ask, is one to be called more homogeneous or more heterogeneous than another? "The portions of which the whole is made up may be severally regarded as minor wholes,"[2] says Mr. Spencer. No doubt they may be, but all such individualisation is, from a strictly mechanical standpoint, purely arbitrary. There may be teleological reasons in plenty, or what we may call methodological reasons, or reasons of practical interest; but all such grounds as these transcend the level of Mr. Spencer's primordial truth and its corollaries. Keeping strictly to that, there is only one true homogeneity, the homogeneity of an undifferentiated plenum such as Descartes or Lord Kelvin supposes. Between such a plenum and an aggregate of elements in motion there is no continuity; to secure the differentiation that an aggregate implies, a catastrophe is indispensable. But once such a system is secured, it is meaningless to call it indefinite or incoherent. A configuration cannot be indefinite; and as the forces between every pair of elements depend solely on their masses and positions, such a system

[1] *Der philosophische Kriticismus*, Bd. ii, 2te Th. p. 75.

[2] *First Principles*, § 155, stereo. ed., p. 428 ; rev. ed., p. 396.

is never incoherent, that is to say, is never disconnected. To the Laplacean calculator, *i.e.* according to what Thomson and Tait call 'accurate mathematical investigation' by 'the only perfect method,' a chunk of granite or even a whirl of dust may be just as definite, just as connected, just as heterogeneous as a chronometer or a balance, just as much a pure mechanism conforming to the laws of energy.* Summing up on this head, then, we may say: (1) That this opposition of homogeneity and heterogeneity is essentially out of place in a rigorously mechanical theory. (2) That on such a theory it is impossible to interpret Mr. Spencer strictly when he says, "The absolutely homogeneous *must* lose its equilibrium and the relatively homogeneous *must* lapse into the relatively less homogeneous";[1] for instability is incompatible with absolute, and independent of relative, homogeneity. (3) That mere indefiniteness and incoherence entitle him to assert nothing either concerning homogeneity, or stability, or anything else.

Any one at the trouble to read at all critically the long chapter devoted to this so-called Instability of the Homogeneous, cannot fail to discover instances in plenty of what I say. Mr. Spencer's main example I may perhaps be allowed to mention, though it has been already exposed;[2] for in this he flatly contradicts the very mechanical principles he has declared to be so

[1] Spite of this Mr. Spencer, in an earlier foot-note, cuts away the ground from under his own feet by bargaining that "the terms here used must be understood in a relative sense." Cf. § 116, stereo. ed., p. 330; rev. ed., p. 302.

[2] Cf. *British Quarterly Review*, 1873, vol. 58.

* See Note vii, p. 597.

unfathomably fundamental. Having, by a series of gratuitous and sometimes erroneous suppositions, advanced from pristine homogeneity as far as "irregular masses of slightly aggregated nebular matter" all in motion, he continues thus: "Established mechanical principles . . . justify the conclusions that the motions of these irregular masses . . . towards their common centre of gravity must be severally rendered curvilinear, by the resistance of the medium from which they were precipitated; and that in consequence of the irregularities of distribution already set up, such conflicting curvilinear motions must, by composition of forces, end in a rotation of the incipient sidereal system."[1] Now this is a gigantic and palpable blunder, one that even the least mathematically-minded might have avoided by reflecting that matter being essentially inert can hardly be conceived to set itself spinning merely because there is plenty of it. This felicitous plan for securing the rotation that Laplace was content to assume conflicts with what is technically called the Conservation of Angular Momentum; and this, it is well known, is directly deducible from Newton's third law. Now the odd thing is that Mr. Spencer—very inaccurately, to be sure—identifies the said law, that action and reaction are equal and opposite, with the law of the conservation of energy. Thus an important scene in his evolutionary drama is out of keeping with its main motive.

Of course Mr. Spencer has had no difficulty in finding instances in plenty of comparatively homogeneous states lapsing into more heterogeneous ones; and had he so

[1] *First Principles*, § 150, stereo. ed., p. 407; rev. ed., p. 377, altered.

minded he could have found just as many instances of 'heterogeneous' states lapsing into more 'homogeneous' ones — as he does indeed when he wishes to illustrate dissolution.* And all such instances alike are conformable to the principle of the conservation of energy; thereby shewing, as we have already seen, that that principle is a sufficient basis for none. Whether an egg is transformed into a chicken, into an omelette, or into rottenness, one change is as much, or as little, as the other deducible from that persistence of force which Mr. Spencer always mentions with such mystic awe. Moreover, all such instances require that besides the homogeneous and unstable object or the heterogeneous and unstable object, as the case may be, there should be external forces affecting it. An egg alone in the void would neither hatch nor cook nor smell: it is on the object + external causes that the result — be it more, be it less complexity — essentially depends. Now the universe, regarded as a single object and homogeneous, has no environment, is not amenable to extraneous forces — a peculiarity that makes Mr. Spencer's instances rather refute than corroborate his main thesis, but confirms on the other hand the antithesis we have opposed to it.

Perhaps the most striking thing about Mr. Spencer's multitudinous illustrations of the transitoriness of all things homogeneous and their inevitable lapses into heterogeneity, is the looseness with which these terms are used. Thus he chooses to regard a circular orbit as homogeneous and elliptic orbits as heterogeneous, and then remarks: "All orbits, whether of planets or satel-

* See Note viii, p. 598.

lites, are more or less excentric . . . and were they perfect circles they would soon become ellipses. Mutual perturbations would inevitably generate excentricities. That is to say, the homogeneous relations would lapse into heterogeneous ones." [1] Now in the first place let an orbit be what it may, the relations determining it are invariable, involve no more factors at one time than at another. But even if an orbit could with propriety be called a relation, it is especially absurd in Mr. Spencer to contrast a circle which is a single figure with ellipses of which there may be an indefinite multitude. Compare an elliptic orbit of definite eccentricity with a circular orbit, which is itself an elliptic orbit of definite, i.e. *zero*, eccentricity, and both appear equally homogeneous and equally stable. Apropos of this a mathematical critic of Mr. Spencer, after comparing him to a man "who thought that Nature had a spite against the figure 3, because he had noticed that it was much more usual to find that a number did not end with 3 than that it did," proceeds to remark: "Of course, if you put all elliptical orbits in one class and leave the circle to form another class by itself, it is likely that the orbit will tend to belong to the first-named class; for it can change through all possible ellipses without altering the *appellation* of its orbit, while the slightest variation from a circle is reflected in a change of name." [2] A blunder of this kind, though it shews how flimsy Mr. Spencer's constructions are, would scarcely be worth mention if it were isolated. Unhappily the fallacy

[1] *First Principles*, § 150, stereo. ed., p. 410; rev. ed., omitted.

[2] *British Quarterly Review*, article above referred to.

underlying it is general and vitiates an indefinite number of 'the great evolutionist's' arguments; for the homogeneous is ever one and the heterogeneous always many.

Yet another instance may be mentioned in view of its subsequent importance. Mr. Spencer devotes one section of his long chapter on the Instability of the Homogeneous to what he calls "chemical differentiations." In the course of it he illustrates the well-known, but for his argument somewhat anomalous, fact that in general "simple combinations can exist at a higher temperature than complex ones," in other words that "chemical stability decreases as chemical complexity increases," so that for example what we ordinarily regard as chemical elements at one extreme cannot be decomposed by any heat that we can artificially produce, whereas organic compounds at the other extreme, which are extremely complex, are readily decomposed at quite moderate temperatures. Now as all ponderable matter is in some chemical state or other, and as the half of our evolutionary formula relates to redistribution of matter, this fact — that the chemically more homogeneous matter is the more stable — surely cuts a monstrous cantle out of the best of Mr. Spencer's realm.[1] I say the best, for here, at any rate, the terms homogeneous and heterogeneous are strictly applicable. The strange thing, however, is that when, in a subsequent volume of

[1] Elsewhere (§ 101) this greater stability of what is chemically homogeneous is accounted for by the comparative absence from it of "contained motion." But even this surrenders the point that the homogeneous, merely as homogeneous, is unstable. It rather suggests the opposite conclusion; if it means anything to talk of motion as what a thing may or may not "contain."

his philosophy, Mr. Spencer comes to treat of the evolution of organic life, this instability of the *heterogeneous* becomes the mainstay of his argument.*

But why, you may wonder, does he bring it forward in a general chapter that has to prove the instability of the homogeneous, where it seems so irrelevant and inopportune? It is the earth's crust which is here the direct object of Mr. Spencer's exposition: his purpose, he says, is "to show how, in place of that comparative homogeneity of the earth's crust, chemically considered, which must have existed when its temperature was high, there has arisen during its cooling, an increasing chemical heterogeneity, each element or compound, being unable to maintain its homogeneity in presence of various surrounding affinities, having fallen into heterogeneous combinations."[1] Let us examine this argument for a moment. If the comparatively homogeneous as such is unstable, then *a fortiori* the altogether homogeneous should be unstable, if the argument is to be worth anything. Let us then, as we surely may, imagine the incandescent globe to have been wholly of oxygen or of silicon, ought we not then to expect that heterogeneous combinations would appear sooner and more conspicuously? Again if the instability is due to homogeneity simply, why is it essential to reduce the temperature and to insure "the presence of various surrounding affinities" before the lapse into heterogeneity can begin? Further, if the homogeneity involves instability, how comes it that once combination has begun "the stability *de*creases as the complexity *in*creases?" Lastly, what

[1] *First Principles*, § 151, stereo. ed., p. 411; rev. ed., p. 380, all after 'heterogeneity' omitted. Italics mine.

* See Note ix, p. 598.

warrant has Mr. Spencer for saying that "each element or compound falls into combination, being unable to maintain *its* homogeneity"? Does he mean that, when oxygen and hydrogen form water, or acid and base form a salt, both components disappear? How then can the combination be called heterogeneous; we should surely have a new homogeneous, presumably as unstable as before! On the whole I think we may say that while Mr. Spencer's main argument here is an instance of the "indefinite incoherent" confounding of things in themselves distinct, it incidentally opens a whole floodgate to facts very damaging to the homogeneity of his theory.

With other instances of the instability of the homogeneous supposed to be deducible from the persistence of energy, such as the development of intelligence and the desynonymisation of words, it is impossible to deal here. Mr. Spencer is considerate enough to anticipate his readers' misgivings so far as to assure them that "any difficulty felt in understanding" these and like instances "will disappear on contemplating acts of mind as nervous functions." All such parts of Mr. Spencer's doctrine, then, may for the present stand over. There remain still two steps in what our cosmic philosopher calls the *rationale* of evolution, its deduction, that is to say, from the persistence of force. At each of these we must glance briefly.

To secure his first step, Mr. Spencer, as we have seen, was led to maintain that the homogeneous is essentially unstable; his second step consists in maintaining that "the effect is universally more complex than the

cause."[1] "This secondary cause of change from homogeneity to heterogeneity," he remarks, "obviously becomes more potent in proportion as the heterogeneity increases,"—in fact, "the multiplication of effects," as he entitles his second step, must, he contends, "proceed in geometrical progression. Each stage of evolution must initiate a higher stage." All these conclusions, of course, he proceeds as before to shew, "are not only to be established inductively, but are to be deduced from the deepest of all truths."[2] And again I can only contend that strictly interpreted this second position is as devoid of foundation as the first, and is only made to look plausible by a very loose use of leading terms and a superabundance of specious analogies.

Let us see, for instance, what Mr. Spencer means by one cause and by many effects. Here is an example. He gives a detailed description of the leading physical features of the earth,—its mountain ranges, irregular coast line, its continents, and its oceans; and then concludes by saying: "Thus endless is the accumulation of geological and geographical results slowly brought about by this one cause—the escape of the earth's primitive heat."[3] The effects, no doubt, are multitudinous enough, but on what ground is the cause accounted one? Suppose the earth to be a single gas cooling under constant pressure, or to consist entirely of one pure metal—the escape of the primitive heat could take place as before, but how many of the endless effects of this one cause would there be left? If such loose and popular language is to pass as scientific induc-

[1] *First Principles*, § 156, stereo. ed., p. 433.

[2] *o.c.*, § 162, stereo. ed., p. 458. [3] *o.c.*, § 158, stereo. ed., p. 438.

tion, it would be every whit as easy to shew that a single effect is due to a multiplicity of causes.* The historian, for example, may in all seriousness so regard the Reformation or the French Revolution, and the more patient and pertinacious he is the more multitudinous the causes he will find for that one result.

But when causes and effects are to be deduced from a quantitative law and expressed in terms of matter and motion, we have a right to expect more precision. Mr. Spencer begins by using the language of the exact sciences, talks much of incident forces, of action and re-action being equal and opposite, and so forth, but in the end he is as careless as one quite ignorant of mechanical principles. Thus, for instance, he first describes the fracture of a stone by a hammer as a case in which a single force is changed by 'conflict with matter' partly into forces differing in their directions and partly into forces differing in their kinds. He then proceeds further to describe the former of these as a change of a homogeneous momentum into a group of momenta, heterogeneous in both amounts and directions. Lastly he mentions as instances of the second the sound produced, the heat disengaged, and the sparks struck off, etc. In the course of half a page force is used in three different senses—as mechanical energy, as momentum, as a physical sense-impression—and all wrong. But, above all, what is to be understood by "a conflict of force with matter?" To the physicist proper, Professor Tait say, for whom matter is essentially passive and inert, such language is nonsense; it can hardly have more meaning for a writer who, like Mr. Spencer, maintains

* See Note x, p. 599.

that matter is force and nothing else. How, we wonder, by the way, did the homogeneous lapse into this kind of heterogeneity?

From the inductions, of which these are specimens, Mr. Spencer next passes to the deduction of this second step from "the deepest of all truths," and in so doing he becomes suddenly very perfunctory. After the parallel deduction in the case of his first step, a like argument, he thinks, "seems here scarcely required," and he is content "for symmetry's sake briefly to point out how the multiplication of effects, like the instability of the homogeneous, is a corollary from the persistence of force." In less than two pages the thing is done, or rather not done, not even attempted — a result which in view of the flimsiness of the inductive argument is only to be regretted. What Mr. Spencer has to prove can be stated simply enough. It is that if "the quantity of Force remains always the same," there must be, and unless the quantity of Force remains always the same, there cannot be, what he calls the multiplication of effects in geometrical progression. What he actually does, however, is merely to draw out with needless parade a proposition, which, as he is frank enough to allow "is in essence a truism," viz., that unlike causes, or, as he prefers to say, 'unlike forces' will have unlike effects. To this he merely appends the remark that each different modification "must produce its equivalent reaction; and must so affect the total reaction. To say otherwise is to say this differential force will produce no effect, which is to say that force is not persistent."[1] In a word, instead

[1] *First Principles*, § 162, stereo. ed., p. 457; rev. ed., p. 422.

of shewing that, given the persistence of energy, there must be this geometrical increase in the diversity of effects, what Mr. Spencer does is to assert that given this diversity, every effect is the equivalent transformation of its cause — which is not to deduce anything as a consequence of the law of conservation; it is only a needless reiteration of the law itself.

We come at length to the final step in the *rationale* of evolution. Mr. Spencer devotes to it the last chapter of his exposition of this subject, and his opening sentences ought to surprise us: "The general interpretation of Evolution," he begins, "is far from being completed in the preceding chapters. . . . Thus far no reason has been assigned why there should not ordinarily arise a vague chaotic heterogeneity in place of that orderly heterogeneity displayed in Evolution." "We have found . . . that the homogeneous must lapse into the heterogeneous and that the heterogeneous must become more heterogeneous." "But," says our author, "the laws already set forth furnish no key to this arrangement in so far as it is an advance from the indefinite to the definite." As to the advance from the incoherent to the coherent the key to this, we must suppose, is furnished by that 'simplest and most general aspect' of evolution to which Mr. Spencer ascribes the mere integration or aggregation of matter. But there is, it seems, a further "local integration" or segregation of like from unlike in the heterogeneous mixture. Now it is by this process that orderly heterogeneity arises out of the vague and chaotic. Surprised as we naturally are to find ourselves thus near to the close of the great interpretation, and yet not out

of the range of chaos, we await with some anxiety the rationale of this final step by which at the last moment a cosmos is secured. "The rationale," says Mr. Spencer, "will be conveniently introduced by a few instances in which we may watch this segregative process taking place."[1]

Let us be content with one and that the briefest of these instances: "In every river we see how the mixed materials, carried down, are separately deposited—how in rapids the bottom gives rest to nothing but boulders and pebbles; how when the current is not so strong, sand is let fall; and how, in still places, there is a sediment of mud."[2] After this and other introductory instances and an assurance that there are countless similar ones, we have the following generalisation: "In each case we see in action a force which may be regarded as simple or uniform—fluid motion in a certain direction at a certain velocity. . . . In each case we have an aggregate made up of unlike units—unlike in their specific gravities, shapes, or other attributes. . . . And in each case these unlike units or groups of units, of which the aggregate consists, are, under the influence of some resultant force, *acting indiscriminately on them all*, separated from each other—segregated into minor aggregates, each consisting of units that are severally like each other and unlike those of the other minor aggregates."[3] Thus we see that even the transition from the indefinite to the definite, from the vague and chaotic to the cosmical and orderly, is assigned to "force acting indiscriminately."

[1] *First Principles*, § 163, stereo. ed., p. 459; rev. ed., p. 423.

[2] *o.c.*, § 163, stereo. ed., p. 460; rev. ed., p. 424.

[3] *o.c.*, § 163, stereo. ed., p. 461; rev. ed., p. 425. Italics mine.

Mens agitat molem is a maxim for which the mechanical theory of evolution has nowhere a place. It is at any rate satisfactory to come to the end and be clear on this point. But I must defer general reflections till the next lecture. For the present let us be content with briefly considering how this indiscriminate sifting process will work in conjunction with the other two.

A good deal will depend on their respective intensities, how they are matched against each other; for it is obvious that in several respects the process of segregation will counterwork the two other causes of evolution. Thus, in producing local integrations of like units, it must act counter to the instability of the homogeneous, according to which the like lapses into the unlike. In so doing, again, it will frustrate the multiplication of effects within the limits of such local integration, for this is efficient 'in proportion as the parts are unlike.'[1] Imagine segregation to have been in full play while the existing chemical elements of the solar system, though present in the nebula, were still uncombined, and that in consequence these elements were separated into minor aggregates severally like each other and unlike the rest — those of high specific gravity or strong physical likeness near together and the unlike far apart. Thus the conceit of the alchemists that the seven metals correspond to the seven planets might have been realised; and as to the gases, oxygen, hydrogen, nitrogen, indispensable constituents of living things — they might have been sifted off into space before planetary consolidation began. We know of

[1] *First Principles*, § 162, stereo. ed., p. 458; rev. ed., p. 422.

course that this has not happened or we should not be here. But if Mr. Spencer's principle of segregation is really the potent factor in evolution that he takes it to be, it is at least remarkable to find that with a whole nebula as a field for its activity and untold ages in which to work, it has nevertheless left no trace of itself. Let me quote an excellent authority. "We do not find them [*i.e.* the chemical elements]," said Sir William Crookes in his British Association Address, "evenly distributed throughout the globe. Nor are they associated in accordance with their specific gravities, the lighter elements placed on or near the surface and the heavier ones following serially deeper. Neither can we trace any distinct relation between local climate and mineral distribution. And by no means can we say that elements are always or chiefly associated in nature in the order of their so-called chemical affinities: those which have a strong tendency to form with each other definite chemical combinations being found together, while those which have little or no such tendency exist apart." Then definitely raising the question,— but without any reference to Mr. Spencer, let me say, —"Is there any power which regularly and systematically sorts out the different kinds of matter from promiscuous heaps, conveying like to like and separating unlike from unlike?" this distinguished chemist answers: "I must confess that I fail to trace any such distributive agency, nor indeed, do I feel able to form any distinct conception of its nature."[1] Surely Mr. Spencer should have had something to say to this, but

[1] *Nature*, 1886, vol. xxxiv, pp. 425 f.

though his new edition has an admirable index, there is no mention of Sir W. Crookes.

One other point as to the relation of the two chaotic or differentiating processes to this cosmic, selectively integrating, principle. At first blush the situation reminds us of that intellectual guidance referred to in the last lecture, when we were distinguishing teleological from mechanical evolution. When human ingenuity constructs a machine or a house, or when Maxwell's sorting demon separates molecules moving with more than average velocity from those moving with less, the processes are what Mr. Spencer might call processes of segregation and local integration. But they differ from Mr. Spencer's process in several respects. First, the result is secured, not by a force acting indiscriminately, but by intelligence counterworking the downhill trend of energy towards dissipation. Also in the case of the products of human skill the result is rather that unlike things are brought together than that unlike things are separated. Nowhere do we find so little segregation, in the sense of Mr. Spencer's sifting and winnowing processes, as in living organisms and the products of human industry. Lastly, organisms and machines are not aggregates of aggregates, but individuals consisting of members. Spite of these essential differences, Mr. Spencer, no doubt, thinks mechanical segregation will cover both, and it must be confessed that by sufficient license in the use of the term 'force' and the free substitution of unit for fragment, individual for aggregate, and the like, the task is feasible, — and the result quite worthless. When sparks rise and dust falls we say each moves along the line of least re-

sistance, their densities and gravitation being the segregating forces; and when the virtuous man 'rises' and the vicious 'falls' we may, if we like, say again that each follows the line of least resistance, and may call their desires and public opinion the segregating forces. This is what Mr. Spencer does like to do; it is what he calls synthetic philosophy.

LECTURE IX

REFLEXIONS ON MR. SPENCER'S THEORY: HIS TREATMENT OF LIFE AND MIND

The conclusions to which we were led in examining the mechanical theory apply here. It is impossible to get more out of a theory than there is in it. Out of space, time and mass, however manipulated, progress, development, history, meaning, can never be deduced.

How has Mr. Spencer come to think this possible? His procedure illustrated. He succeeds by means of formularies that seem to have always a strictly *mechanical sense, though they are frequently only* figuratively *mechanical. Indeed, he outvies the mechanical theorists by his more fundamental analysis as well as by his completer synthesis. But he confounds abstraction with analysis; and abstracts till he has no content left. The eliminated elements are then gradually resumed under cover of the principle of continuity. The existing gaps in scientific knowledge help to cloak such recoveries.*

An instance in Mr. Spencer's transition from Inorganic Evolution to Organic Evolution. Two volumes of the Synthetic Philosophy *missing.*

Mr. Spencer's somersault in passing from Life to Mind. After all, the interpretation of Spirit in terms of Matter is allowed to be 'wholly impossible.'

I HAVE called Mr. Spencer an eclectic. His synthetic philosophy is made up of Hamilton's theory of the Unconditioned, of the physical theory of the conservation of energy as expounded by Grove, of the nebular hypothesis of Laplace, and of what used to be called the development hypothesis, or the doctrine of the transmutation of species. The Darwinian form of this doctrine came too

late to be satisfactorily incorporated in his system, still Mr. Spencer was not slow to turn it to account as far as he could. Of his work Darwin, writing to one of its chief exponents, Professor Fiske, thus expresses himself: "Such parts of H. Spencer as I have read with care impress my mind with the idea of his inexhaustible wealth of suggestion, but never convince me; and so I find it with some others. I believe the cause to be the frequency with which I have found first-formed theories erroneous."[1] In passing presently to this narrower subject of biological evolution, I do not propose to refer so fully to Mr. Spencer's views.

In the existing state of knowledge this topic of biological evolution is widely different in subject-matter and methods from the cosmological speculations into which Mr. Spencer attempts to frame it. Here we deal with concrete objects and a vast collection of empirical observations concerning them. The axioms of physics and its ideal conceptions of atoms, ethers, and the like have to be left aside, temporarily at all events. We are forced back upon them again when the dominant naturalistic explanation of the relations of life and mind to their so-called "physical basis" confronts us. But having reached a dividing line of this magnitude, it seems appropriate, before proceeding, to attempt a retrospective summary of Mr. Spencer's cosmological presentment of evolution as a deduction from mechanical principles.

It was open to us perhaps to urge at the very outset that such an enterprise was foredoomed to failure. For

[1] *Life and Letters of Charles Darwin*, vol. iii, p. 194.

what Mr. Spencer essays to do is to set before us "the entire history" of things, "considered individually or in their totality"; and to set all this before us as the direct and necessary consequence of a principle of permanence which gives no clue to processes, transformations, or changes of any kind — to say nothing of furnishing the rationale of all processes and changes of every kind whatever. It is as if we had the philosophy of Heraclitus deduced from the premisses of Parmenides. Even when we allow Mr. Spencer to substitute the entire body of hypotheses constituting abstract dynamics for his Eleatic principle of "the impossibility of establishing in thought a relation between something and nothing,"[1] the case is not mended. True this transcendent but rather empty principle is not equivalent to the physical doctrine of the conservation of energy; and again the conservation of energy, so far from constituting the sole and sufficient foundation of physical science, only furnishes one of several equations — to put it technically — by which a given transformation is determined. But even if we add to it the principle of least action and all the hypotheses necessary to make a mechanical 'interpretation' of things as complete as such an interpretation can be, still it will be hopelessly inadequate to the "entire history of things considered individually and in their totality." In fact, the conclusions to which we were led in examining the mechanical theory must apply straightway to what is itself but an application of that theory — the resolution of all history into "a total and all-pervading process of redistri-

[1] *First Principles*, § 61, stereo. ed., p. 191; rev. ed., omitted.

bution of matter and motion." It is impossible to get more out of such a theory than there is in it. Between one stage of the process and another there can only be such differences as dynamical diagrams, time-charts, hodographs, and the like will give. The entire history of things would thus be nothing better than the monotonous uniformity of a long series of gigantic Nautical Almanacs. Change there would be certainly, but only change of motion, change of grouping of unchangeable elements, unchangeable because utterly devoid of qualitative diversity or internal character. Progress, development, history, meaning — of these there would be nothing. It is obviously impossible to get such conceptions out of space, time, and mass, as quantities; or out of any relations between them, for these in turn are only quantities. We have only the night — to appropriate a *mot* of Hegel's — when all cows are black. Everything is dynamical diagram: to this common level "celestial bodies, organisms, societies" will all alike have somehow to be reduced.

But how then does Mr. Spencer deceive himself into imagining that he finds increasing purpose, advancing harmony, final perfection, what he is pleased to call a "Philosophico-Religious doctrine,"[1] in a purely quantitative scheme; a scheme to which all such notions as adaptation, perfection, and happiness are absolutely disparate? The answer is simple and the fallacy to which it has led is clear. There are two points to notice. First, like the rest of us, Mr. Spencer sets out from the concrete world which is only intelligible to us so

[1] *First Principles*, § 194, stereo. ed., p. 557; rev. ed., p. 509.

far as we can regard it as a world of individuals, a world full of purpose and of adaptations, a world to which such notions as worth, progress, and perfection are applicable.[1] Looking at this world, then, historically, we can range its facts in an ascending order of complexity and value — physical, biological, psychological, social, and so forth. But as we make this ascent we have at every advance to take up new conceptions: the facts of biology cannot be expressed in purely physical terms; psychology will not resolve into biology nor sociology into psychology. It would be sheer waste of time to enlarge upon a point so perfectly obvious, though for any attempt at a theory of knowledge it is a point of vital importance. For Hegel — who also was an evolutionist, but one occupying a standpoint the diametrical opposite of Mr. Spencer's — the exhibition of this hierarchy of categories was the main problem; for Mr. Spencer it is no problem at all. His works testify on every page that such an ascending scale of conceptions is there and unavoidable. But the fact gives him not a moment's pause; it is only one more instance of the passage of matter from indefinite, incoherent homogeneity to definite coherent heterogeneity!

And so we come to the second point, and this again it is enough barely to mention. Whatever be its meaning, its purpose, or its life, the cosmos in one aspect is but matter in motion. However difficult to formulate without appearing to prejudge the ancient and

[1] "Constituted as the human mind is, if nature be *not* interpretable through these conceptions, it is not interpretable at all." Sir J. Herschel on *The Origin of Force* in the *Fortnightly Review*, vol. i, p. 442.

obstinate problems to which it has given rise, this fact is none the less in itself both familiar and unquestionable. The world of ideas is in some way presented through, and embodied in, the world of sense; and the sensible can be summarised in terms of matter, motion, and force. And now it is by his mode of dealing with these two planes of thought that Mr. Spencer has deceived himself into thinking that he has encompassed the entire history of things within the scope of a materialistic formula. He *advances* by way of the ascending scale of ideas, the concrete progress from physics to life, from life to mind, from mind to reason; but he professes to *explain* by falling back on the abstractions of pure dynamics. Yet on this level, if we could imagine ourselves confined to it, there is, as I have frequently urged, no real advance, no true evolution at all. Space and time, of course, do not alter; also mass-elements do not alter; and so between one configuration, one diagram, and another, of a given number of such elements, there is no essential difference. But when we command *both* the dead level of changing configurations and *also* the ascending complexity of the concrete sciences and their categories, then we may make a shift to call one material system a pumpkin and another a poet. Only however because we first know pumpkins and poets as such. To suppose then, that the transformation of one such configuration into another furnishes any clue to the evolution of poets is a glaring and ridiculous blunder. But it is for this blunder that Mr. Spencer is vaunted by Tyndall as an "Apostle of the Understanding whose ganglia are sometimes the

seat of a nascent poetic thrill."[1] Let me try to make this point clearer by means of an imaginary case involving the same sort of fallacy. Take a shelf of miscellaneous books in the English language,—books on mathematics, chemistry, physiology, history, art, literature, or what you will,—and imagine a private student setting to work to improve his mind, as we say, by means of them. It will not be indifferent in what order he reads: to understand the physiology he will often find himself thrown back on the chemistry, to understand the chemistry he must often consult the mathematics; the art and the literature will be full of allusions to the history. Above all, the whole will presuppose that the student himself is a person with sense, intelligence, feeling, conscience. Nevertheless, if we are not to be too severe on the synthetic philosophy, we had better leave the student, as much as may be, out of account.

Now let us introduce a man of letters with a Spencerian sense of thoroughness. The first step, he will say, must be to analyse all this material; and only an ultimate analysis will suffice: we must not pause till we have reached the imperceptible. Specialists, he will continue, have already provided nomenclatures and terminologies, glossaries, indexes of persons and things, and the like. Passing beyond all this un-unified knowledge, the lexicographer provides us with partially unified knowledge, and covers the whole range of these books by an adequate dictionary of the English tongue. We get still nearer to that ultimate analysis that must

[1] Belfast Address before the British Association, 1874, p. 49.

underlie completely unified knowledge when we can exhibit the letters of the alphabet as the constituents of English as it is, was, and will be. But even these letters are made up of strokes of two kinds, viz., straight strokes and curved strokes; and only when these are disintegrated into the primordial dots of which they must be compounded, and these dots duly dissipated, have we reached that ultimate and imperceptible state where rational synthesis must begin. Evolution then arises as this dissipation gives place to concentration, and with increased concentration comes increased differentiation; and so we advance from dots to strokes, from strokes to letters of various forms, from these to syllables "with a subsequent advance to dissyllables and polysyllables and to involved combinations of words"—the heterogeneity steadily increasing in geometrical progression. As these aggregates of letters grow in complexity and definiteness more wide-reaching interdependences become manifest: in short, what is called grammar and sense arise. But not only do we find in these the same processes of integration, differentiation, and segregation already exemplified; they are also themselves objectively presented and more or less permanently registered in literal form. Then, when at length the change which evolution presents is complete and equilibration is reached, we have, in what we know as stereotype, that perfection, harmony, and complete congruity which the ten volumes constituting the synthetic philosophy so admirably illustrate. To be sure, this interpretation of all literary phenomena in terms of integrated black and diffused white is nothing

more than the reduction of complex phenomena to their simplest forms, and as that philosophy shews "when the equation has been brought to its lowest terms the symbols remain symbols still."[1] No doubt, "most persons," as the author of that philosophy remarks, "have acquired repugnance to such modes of interpretation." But, as he further truly says, "whoever remembers that the forms of existence [in his case Matter and Motion, in ours print and paper] which the illiterate speak of with so much scorn, are shewn to be the more marvellous in their attributes the more they are investigated, . . . will see that the course proposed does not imply a degradation of the so-called higher, but an elevation of the so-called lower."[2] From the infant's primer with its strokes and pothooks up to the pages of Newton and Spencer, we discern the same evolving aggregate, not progressively integrating simply, but simultaneously undergoing various secondary redistributions: the structural complexities thus emerging being ever accompanied by the functional complexities known as grammatical, logical, literary, scientific, and so forth. Given the indestructibility of ink and the persistence of paper, together with the various derivative laws that are their corollaries and consequences, then it can be shewn—adapting the words of our great evolutionist—not only how the grammatical elements exhibit the traits they do, but how books are evolved, thoughts generated, and civilisations achieved. But deny our fundamental datum, or, as Mr. Spencer says: "Let idealism be true, and evolution is a dream!"

[1] *First Principles*, § 194, stereo. ed., p. 556; rev. ed., p. 510.

[2] *o.c.*, § 194, stereo. ed., p. 556; rev. ed., omitted.

Very ridiculous, of course, but not more essentially ridiculous than Mr. Spencer's procedure. The plausibility of his cosmic philosophy is due entirely to the ingenuity with which he has devised a set of formularies that seem, till closely scrutinised, to carry always the same meaning; though at one time they are used in a *strictly* mechanical sense, while at another they are only figuratively mechanical. The illusoriness is the more complete and captivating because it is the ingrained habit of human intelligence to betake itself to metaphor and parable. The current scientific terminology is full of such, and we only realise that we have been talking in similes when the progress of knowledge has enabled us to outgrow them. Thus we now repudiate as fanciful the powers of Love and Hate working between the elements, as Empedocles represented; though we still talk with little misgiving of attractive and repulsive forces, of chemical affinities and bonds; speak of organisms acquiring and bequeathing, and of seeds or eggs as inheriting; and so forth. All this plenitude of metaphor is grist to the Spencerian mill. Moreover, to the 'pseudo-thinking'—I borrow his favourite phrase—which science allows to pass as sterling coin, this latest Paracelsus has added abundance of his own counterfeit.

The lesson which our reflexions on the mechanical theory seemed to teach has apparently never dawned upon him, although perhaps that lesson is nowhere more impressively taught than it is in his own *First Principles*. According to that, philosophy must start from the unknowable, science from the imperceptible. Knowledge is to be unified by ruthlessly abstracting from the

concrete real all qualitative specification. Celestial bodies, organisms, societies, are to be reduced to their lowest terms, viz., Matter, Motion, Force; and are to find their rationale in the instability of the homogeneous, the segregation of the heterogeneous, and the tendency of all things towards equilibrium. Surely this is not very unlike trying to find the meaning of a book by first distributing the type and then mincing them up into strokes and dots. Like the physicists who think to attain "a knowledge of what actually goes on behind what we see and feel," by treating the ideal abstractions of pure mechanics as the real things, so Mr. Spencer essays to find the fullest meaning of evolution among its emptiest symbols, to deduce the form and life of the universe from an Indeterminate and Unchanging Non-relative, which "the imbecilities of our understanding," as he tells us, prevent us from either comprehending or rejecting. The farthest point to which Philosophy, or knowledge of the highest degree of generality, can attain in seeking to comprehend this inscrutable fetish, supposed to be the Supreme Reality, is reached when all separate truths are resolved into implications of one *a priori* truth, the Persistence of Force. The experience of force is assumed to last out through the process of abstract analysis and generalisation, and to remain as long as any content remains; beyond this, we have only indeterminate, non-relative Existence or Persistence, being without content, as the supreme, ineffable generalisation of all. Thus Mr. Spencer outvies your speculative physicists in both directions; his ultimate analysis goes beyond theirs, and in his subsequent syn-

thesis phenomena of all kinds are to be included. And by so much as the range of his formulæ exceeds theirs, by so much are his results illusory and worthless. Lord Kelvin's speculations, for example, were restricted to the deduction of material phenomena from the motions of a structureless primordial fluid; and he is careful to say "that the beginning and the maintenance of life on the earth is absolutely and infinitely beyond the range of all sound speculation in dynamical science."[1] Lord Kelvin, too, it will be remembered, proposed to test all his hypotheses by the construction, real or imaginary, of a mechanical model — thus shewing unmistakably that Matter, Motion, and Force were to be taken in a strictly literal sense. And this, of course, is, if anything, still more true of physicists of the Kirchhoff school, for whom these concepts are literally mathematical abstractions, not real existences. How, then, does it come about that Mr. Spencer imagines he can set forth the entire history and rationale of the universe in such terms? Do mechanical models of organisms and societies arise and work before his philosophic eye, or can his transcendent mathematical genius apply the equations of motion to such phenomena and sum them up in generalised coördinates as yet undreamed of? Nothing of the sort. It is simply the superiority of ignorance that enables him to soar even in a vacuum. Severe as is the following characteristic of Mr. Spencer's powers, it is, to my thinking, as just as it is discriminating. I quote again from a review which, though anonymous, is known to have been written by a dis-

[1] *Properties of Matter*, p. 415.

tinguished lawyer and mathematician: "The flexibility of meaning that characterises well-known formulæ when they come into his [Mr. Spencer's] hands, combined with an incapacity for distinguishing between real and apparent analogies, enables him ever to find, on the one hand a principle, and on the other a multitude of examples, to support each of his positions, and imparts to his style 'the semblance of perpetually hitting the right nail on the head without the reality.' If there be any part of science that Mr. Spencer knows thoroughly, and where his positions are right ones, his writings will there be highly valuable and suggestive. But what these parts are we must learn from others, for Mr. Spencer cannot tell when he does not understand a subject; and his mind is such that it allows him to frame inductive and deductive proofs of his propositions, with almost equal facility, whether they be true or false."[1]

To pass to particulars. The hopeless vagueness of Mr. Spencer's conception of Force is notorious, and has been already sufficiently referred to. But there is a further point, which I should like to make clearer, in which Mr. Spencer is more or less at one with those whom we may call the realistic physicists as distinguished from physicists of the Kirchhoff school,—and that is in confusing abstraction with analysis. It was to such a confusion that we attributed the notion of the realistic physicist that the way to a knowledge of what actually goes on behind what we see and feel lies through hypothetical constructions in the region of abstract mechanics. Sharing in this view and unencum-

[1] Lord Moulton, *British Quarterly Review*, vol. lviii, p. 504.

bered with precise knowledge, Mr. Spencer thinks he can succeed in interpreting the detailed phenomena of Life and Mind and Society in terms of Matter, Motion, and Force. The avowed presupposition of such a synthesis is the belief that by a prior analysis those phenomena have been reduced to these lowest terms. This belief, then, I contend, is due to a confusion between abstraction and analysis.

No doubt these two processes are intimately connected, inasmuch as in abstracting we also analyse and in analysing we also abstract. And yet there is an important difference, and it is this that Mr. Spencer and others beside him have overlooked. As to the procedure in abstraction as such, what Bentham styled "the matchless beauty of the Ramean tree" has, since the days of Porphyry, furnished its classic type. Here, as every one knows, we ascend by successively ignoring essential characters. Starting from some given concrete reality, we rise through a strictly indefinite series of intermediate species or genera to the *summum genus* or *genus generalissimum*, BEING; to a conception, that is to say, devoid of assignable content and only formally distinguishable from its contradictory Non-being. As to analysis — this unfortunately is an ambiguous term. Perhaps the usage in chemistry is the most appropriate, as it is the most literal. Here then we resolve a whole into its constituent elements. And here, in contrast to abstraction, the farther we proceed the more numerous the constituents become. I assume, let me say, that among these constituents we include all those relations of what we may call the

mere elements concerned, without which their subsequent synthesis would be impossible, — relations on which, quite as much as on the mere elements themselves, the nature of the real whole depends. Adopting an illustration of Condillac's, — who compared analysis to the act of taking a watch to pieces, and synthesis to that of putting it together again, — I should say the analysis was incomplete till it sufficed to insure this reconstructive process. Now when the physicist regards things from the mechanical level, we have both abstraction and analysis and also synthesis. We have abstraction in that everything — to requote Maxwell — "is considered under no other aspect than as that which can have its motion changed by the action of force." We have analysis in as far as this conception of mechanism is found to involve the three simple and independent elements of mass and space and time; and we have a basis for synthesis in the laws of motion expressing the relations of these elements. But synthesise as much as we may, the entire result remains abstract; for we cannot by synthesis introduce new elements, any more than by combining two chemical elements we can produce a compound of three. It is because they see this clearly that physicists of the Kirchhoff school repudiate the notion of attaining by merely mechanical investigations to any presentment of "what actually goes on"; and it is because he does not see it at all that Mr. Spencer must rank either as a materialist — and this he disclaims — or as a 'pseudo-thinker.'

In his so-called ultimate analysis, from which his so-

called rational synthesis is supposed to build up, we have *only* abstraction, nothing left to analyse and no basis for synthesis. Let us recall some of his descriptions. How can we analyse 'the uncognisable,' that which is 'deeper than definite cognition,'[1] which "is not the abstract of any one group of thoughts, ideas, or conceptions, but is the abstract of *all* thoughts, ideas, or conceptions, that which is common to them all and cannot be got rid of, 'what we predicate by the word existence,' 'being apart from its appearances?'[2] In short, Mr. Spencer's own words shew unmistakably that his ultimate analysis is that *ne plus ultra* of abstraction, the logically unattainable apex of the Porphyrean tree, a height of abstraction from which there is no return. This abstract analytic procedure Hegel has quaintly compared to the process of peeling off the coats of an onion; now, in what Mr. Spencer calls ultimate analysis, all the coats are gone. If we are now to brush all these aside, it does not greatly matter whether we call what is left Non-being or "being apart from all appearances." It is a question of taste; some prefer one, some the other. The way back to rational synthesis is alike impossible from either. The feats by which Mr. Spencer seems to accomplish it we have admired already. From the persistence of existence to the conservation of energy and from the conservation of energy to the entire body of mechanical principles, two easy steps for Mr. Spencer, and he is in line with the mechanical theory. Having thus conjured himself back from a height of abstraction, avowedly devoid of all definite content, to a definite content admitting of analysis,

[1] *First Principles*, § 62, stereo. ed., p. 192; rev. ed., omitted.
[2] *o.c.*, § 26, stereo. ed., p. 95; rev. ed., p. 82.

we are not surprised to find Mr. Spencer skilful enough to make a show of building up the whole fabric and essential history of life and mind and society in terms of that content, *i.e.* in terms of Matter, Motion, and Force. Having advanced from the indefinite residuum as far as these three coats of his onion and their laws, it seems no longer an impossible feat to conjure all the rest out of these. But I contend that it is only conjuring. The new elements are adroitly taken up as the synthesis advances, although they seem to have been swept from the board before the performance commenced. The process is not legitimate because they are not avowed as parts of the ultimate analysis; because, in fact, this supposed analysis is incomplete, is not analysis but abstraction, on the way to which these elements were left entirely aside.

Mr. Spencer's remarkable qualifications for this kind of work I have tried already to describe and to illustrate — perhaps at undue length. But there is one characteristic of evolution which lends great additional plausibility to his enterprise and to other like enterprises; I mean the extremely gradual advance, the general absence of all discontinuity, that pertains to nature's developments — that trait which is embodied in the familiar axiom, *Natura non facit saltum.* In a nebulous haze compared with the endless variety of the solar system; in the dance of drops in a fountain of water compared with the physiological processes in a living organism; in the *Amœba* compared with *Homo sapiens;* in a group of savages uttering incantations round a newly fallen meteorite compared with the Fellows of the Royal Society discussing

argon, — we see the most divergent extremes of kind. Yet there are innumerable intermediate forms connecting these several extremes by insensible degrees. When we consider the extremes by themselves, as our forefathers for the most part did, the explanation of the more complex extreme confronts us as a formidable problem, however adequate our explanation of the simpler extreme may appear. But nowadays, familiarised as we are with the successional continuity of the intervening stages, we are inclined to imagine either that there is no problem at all, or that, if there is, the problem is solved. Psychologically this may be readily accounted for. Certain well-known sentences of Hume here apply exactly: "The passage is . . . so smooth and easy, that it produces little alteration on the mind, and seems like the continuation of the same action. . . . The thought slides along the succession with equal facility, as if it considered only one object; and therefore confounds the succession with the identity."[1] And so we can understand why, as Sigwart remarks, "the notion of development has sometimes been handled like a logical charm by means of which phenomena hitherto inexplicable are explained with ease." "It is," he continues, "as if we should say, that though force is required to lift a weight a given height perpendicularly, yet if the weight is placed on an inclined plane and this made very long, so that over small lengths the weight would rise only imperceptibly, it might really rise of itself; for the force diminishing as the time increases, if the time taken were very long, force could be dispensed

[1] *A Treatise of Human Nature*, Green and Grose's edition, vol. i, p. 492.

with altogether."[1] But in truth, the law of continuity does not dispense with causal laws, however much it may facilitate genetic description or aid the dissolving views of imagination. Evolution, so far from being a self-sufficient explanation of what are called its results, has itself to be explained; like other processes, it must have its adequate cause. But not merely so. Allowing science to content itself with description, as we have seen that it tends to do, still it is impossible, as we have also seen, to convert the dead letters of the mechanical alphabet into the living sense of things. Other and higher conceptions have to be employed, and no continuity or smoothness of transition will account for these; though it may enable them to slip in easily and unawares, thereby committing science to sophisms of the Sorites type, which philosophic reflexion may find it hard completely to expose. In truth the topic is too difficult and would divert us too widely from our immediate theme if we attempted to discuss it fully here. My present purpose is simply to call attention to this feature of evolutionism.

In pursuance of this object I will only remark further that those serious gaps between the sciences which we have already noticed,[2] so far from being, as we might expect, a hindrance to the effective working of that 'logical charm' seemingly pertaining to the notion of development, really enlarge its scope and enhance its potency. Take, for example, the gap between the inorganic and the organic. Of the origin of life, *if it ever did originate*, we have absolutely no knowledge. But, on the one

[1] *Logic*, § 100, 15.
[2] Cf. Lecture I, pp. 8 ff.

hand, there is no definite limit to the possible complexity of mechanical processes, nor any definite limit, on the other, to the possible simplicity of life. Thus in science we have every facility and many temptations to assume that somewhere in the *terra incognita* between physics and physiology mass-aggregates become so configured as to take on the functions and individuality of organisms. Meanwhile — and again contrary to expectation — the progress of knowledge and especially of that systematic reflection concerning knowledge, which takes knowledge itself as the object of science, the science we call epistemology, instead of making this conjectural transition easier, renders it increasingly hazardous and difficult. In proof of this it may be enough here to contrast the light and airy way in which Mr. Spencer glides over this problem, with the confidence of physicists like Lord Kelvin or Helmholtz, or of physiologists like Liebig and Pasteur, that mechanical theories as to the origin and maintenance of life are hopeless.

To be sure Mr. Spencer tells us, when hard pressed by critics, that of the synthetic philosophy "two volumes are missing" — the two important volumes on Inorganic Evolution. "The closing chapter of the second of these volumes" — he continues — "*were it written*, would deal with the evolution of organic matter — the step preceding the evolution of living forms. Habitually carrying with me in thought the contents of this unwritten chapter, I have, in some cases, expressed myself as though the reader had it before him; and have thus rendered some of my statements liable to misconstruction." [1]

[1] *Principles of Biology*, stereo. ed., vol. i, p. 480; rev. ed., p. 597. Italics mine.

Surely this is a situation not wanting in humour — or in pathos! Who is the more to be pitied: the sympathetic readers, who — through no fault of their own, as Mr. Spencer allows — have misunderstood, lacking as they have done for thirty years these two missing volumes of the stereotyped philosophy; or poor Mr. Spencer himself, with these unwritten volumes in his teeming brain, compelled all that time to see his statements misconstrued? Still we must take facts as we find them. During the thirty years in which Mr. Spencer has been engrossed with this interpretation, a whole generation of biologists has striven hard, but striven in vain, to bring this truth to light. For all but Mr. Spencer, at any rate, the origin of life has remained a mystery.

So far as I can gather from his summary references to this unwritten section of his philosophy, Mr. Spencer's procedure there differs in no respect from his procedure generally. And unless I misconstrue it, it exactly illustrates what I have said, and amply justifies the animadversions I have made. On the one hand we have statements purporting to be strictly mechanical; on the other, conceptions not mechanically intelligible slipping in unawares and gradually changing the *venue*. More definitely, on the one hand we have a chemical molecule increasing in complexity till we reach the proteids. Then — I here quote Mr. Spencer — "the supposition (justified by analogies)" that atoms of sulphur or phosphorus "may be a bond of union between half a dozen different isomeric forms of protein." And so, — continues Mr. Spencer, and getting bolder, — "a moment's thought will show that, setting out with the thousand

isomeric forms of protein, this makes possible a number of their combinations almost passing the power of figures to express. . . . Molecules so produced, perhaps exceeding in size and complexity those of protein as those of protein exceed those of inorganic matter, may, I conceive, be the special units belonging to special kinds of organisms."[1] So far, except that Mr. Spencer premises that the ordinary idea of mechanical action must be greatly expanded, *i.e.* that we are to take the full benefit of mechanical hypotheses concerning physical and chemical phenomena — so far, with this proviso, we are still within the range of our lowest terms, Matter and Motion. We are only asked to imagine a very complex cluster of very complex chemical molecules.

But we find ourselves elsewhere approaching this aggregate from the distinct standpoint of biology; and then Mr. Spencer proceeds as follows: "Exposed to those innumerable modifications of conditions which the Earth's surface afforded, here in amount of light, there in amount of heat, and elsewhere in the mineral quality of its aqueous medium, this extremely changeable substance must have undergone now one, now another, of its countless metamorphoses. And to the mutual influences of its metamorphic forms under favouring conditions, we must ascribe the production of the still more composite, still more sensitive, still more variously-changeable portions of organic matter, which, in masses more minute and simpler than existing Protozoa, displayed actions verging little by little into those called vital. . . . Thus, setting out with inductions from the experience of

[1] *Principles of Biology*, stereo. ed., vol. i, p. 486; rev. ed., p. 703.

organic chemists at the one extreme, and with inductions from the observations of biologists at the other extreme, we are enabled deductively to bridge the interval — are enabled to conceive how organic compounds were evolved, and how, by a continuance of the process, the nascent life displayed in these became gradually more pronounced."[1] In other words, going farther in the way of complexity than chemical inductions directly warrant, and farther in the way of simplicity than biological observations directly justify, these two lines of conjecture may meet somewhere in the unknown interval, and *there* will be the source of life. After this triumphant deduction, is it not captious and unkind to object, when — without further explanation — portions of an extremely changeable stuff are declared to have assumed the unity and permanence of individuals? Or when particles of this stuff, now spoken of as living, are credited with "an innate tendency to arrange themselves into the shape of the organism to which they belong,"[2] 'tendencies derived from the inherited effects of environing actions?' Or again when, though scornfully repudiating the hypothesis of a *nisus formativus*, or vital principle, Mr. Spencer allows himself to talk of "the polarities of the molecules determining the *direction* in which the *power* [of environing forces] is turned?"[3]

Instead of pausing to comment, let us rather take one more sample of Mr. Spencer's procedure, which lies on the way to our next topic — the transition from life to mind. "The broadest and most complete definition of

[1] *Principles of Biology*, stereo. ed., vol. i, pp. 483 f.

[2] *o.c.*, stereo. ed., vol. i, pp. 180 f.

[3] *o.c.*, stereo. ed., vol. i, p. 488.

Life," he tells us, "will be *The continuous adjustment of internal relations to external relations*."[1] This we are to understand as a dynamic statement, and possibly in the instance first given to exemplify it we might contrive so to understand it — the instance being the correspondence between food assimilated and the temperature of the environment. But how are we to find a dynamic statement in such an instance as this: "A sound or a scent wafted to it on the breeze prompts the stag to dart away from the deerstalker"? A child would understand that adjustment here does not mean any "transformation or equivalence of forces," and that when the stag halts panting in a corrie five miles off, the internal change from fright to a sense of security cannot, like the external change, be exhibited by geometrical or dynamical diagrams. Yet Mr. Spencer's "broadest and most complete definition" is meant to cover both these cases in spite of the important difference—that in the one 'internal relations' refer to states of the organism, and involve all the three physical terms, space, time, and mass, while in the other 'internal relations' refer to states of mind, and so far can involve neither space nor mass. Now we shall all admit that it is a somewhat hazardous enterprise to set out "to interpret in terms of Matter, Motion, and Force" — such, it will be remembered, is the classic phrase — phenomena into which it is allowed that matter, motion, and force do not enter. The difficulty is two-fold: first, to get rid of extension; and then, since with extension matter goes too, to get back the real in some

[1] *Principles of Biology*, § 30, stereo. ed., p. 80; rev. ed., p. 99.

other form. But it is just in these 'disastrous chances' that Mr. Spencer's characteristics come out. That you may learn in his own words how he resolves the first difficulty, how from internal relations of the organism he passes over to internal relations of the mind, let me quote from his *Principles of Psychology*. The following is part of a chapter devoted to elucidating the nature of intelligence:—"The skin, then, being the part immediately subject to the various kinds of external stimuli, necessarily becomes the part in which psychical changes are originated. . . . Speaking generally, therefore, we may say that while the physical changes are being everywhere initiated throughout a *solid*, the psychical ones, or rather those out of which psychical ones arise, admit of being initiated only on a *surface*."[1] So one dimension of this too, too solid flesh melts; to understand how the other two disappear let us hear Mr. Spencer further. "Those abilities which an intelligent creature possesses, of recognising diverse external objects and of adjusting its actions to composite phenomena of various kinds, imply a power of combining many separate impressions. These separate impressions are received by the senses—by different parts of the body. If they go no further than the places at which they are received, they are useless. . . . That an effectual adjustment may be made, they must all be brought into relation with one another. But this implies some centre common to them all through which they can pass; and as they cannot pass through it simultaneously they must pass in suc-

[1] *Principles of Psychology*, vol. i, p. 401.

cession, so that as the external phenomena responded to become greater in number and more complicated in kind, the variety and rapidity of the changes to which this common *centre*[1] of communication is subject must increase — there must result an unbroken series of these changes — there must arise a consciousness."[2] Just as extension reduces to a point, consciousness appears!*

It would look as if a punctual seat of the soul were as much a necessity for Mr. Spencer as it was for Descartes. But Mr. Spencer's dynamic principle recognises no substance but matter, and that has gone with space. This brings us to the second difficulty.

How are we to interpret the intelligent creature for whom this hurrying single file of impressions is brought into relation? Since it cannot be what it ought to be (if it is to be rationally built up according to Mr. Spencer's ultimate analysis), since it cannot be matter, and must be something, what, we wonder, is it? Now for the *deus ex machinâ*. Turning to his chapter on the Substance of Mind, we read: ". . . The concept we form to ourselves of Matter is but the symbol of some form of Power absolutely and forever unknown to us; and a symbol which we cannot suppose to be like the reality without involving ourselves in contradictions. . . . Also the representation of all objective activities in terms of Motion, is but a representation of them and not a knowledge of them. When with these conclusions . . . we join the conclusion lately reached that Mind also is unknowable, and that the simplest form under which we can think of its substance is but

[1] Italics mine. [2] *Principles of Psychology*, vol. i, p. 403.

* See Note xi, p. 599.

a symbol of something that can never be rendered into thought; we see that the whole question is at last nothing more than the question whether these symbols should be expressed in terms of those, or those in terms of these—a question scarcely worth deciding."[1]

What's in a name? The rose by any other name would smell as sweet, and when it is no longer convenient to call our 'real' matter, why not call it mind? Why not indeed? Most of us here, I dare say, have no objection. Still the somersault is a little startling even from our poet-philosopher, who in concluding his *First Principles* we remember had said: "The interpretation of *all* phenomena in terms of Matter, Motion, and Force is nothing more than the reduction of our complex symbols of thought to the simplest symbols." Our surprise is the greater because here in this chapter on the Substance of Mind he calmly remarks: "It seems easier to translate so-called Matter into so-called Spirit, than to translate so-called Spirit into so-called Matter (*which latter is, indeed, wholly impossible*). . . . Our only course," he continues, "is constantly to recognise our symbols as symbols only; and to rest content with that duality of them which our constitution necessitates."[2] But now what has become of the complete unification of the knowable in view of this utter dualism; and how now are the complex facts of intelligence and morality, of man and society, to be rationally 'built up' on the doctrine of the conservation and transformation of energy? No wonder Mr. Spencer has ever and anon to enter a *caveat* such as this, which

[1] *Principles of Psychology*, vol. i, p. 159. [2] *Op. cit.*, i, p. 161. Italics mine.

occurs in his treatment of social phenomena: "Though evolution of the various products of human activity cannot be said directly to exemplify the integration of matter and the dissipation of motion, yet they exemplify it indirectly."[1] From synthetic interpretation to indirect exemplification is verily a descent, nay, is the most palpable failure. How very indirect even the exemplification is may be judged from Mr. Spencer's final statement of the psychological side of his great primordial truth, viz., that "all mental action whatever is definable *as the continuous differentiation and integration of states of consciousness*."[2] This does not seem to *mean* the same thing as the continuous integration of matter and dissipation of motion; still it *sounds* a little like it.

Here, then, is a thinker really following where he essays to lead, professing to give the sciences their bearings, but in fact losing his own as he goes along. He looks at things, first of all, chronologically, and begins with the generalities of abstract dynamics, which he mistakes for natural laws. The gap between this abstract science and our empirical knowledge concerning physical phenomena, together with the whole group of physical sciences, is passed over. And when Mr. Spencer, omitting two whole volumes, resumes his task with what he calls the interpretation of Organic Nature, he seems quite unaware that he has passed not only from the abstract to the actual, but from the mechanical to the teleological. Regarding living things as a whole,

[1] *First Principles*, § 111, stereo. ed., pp. 318 f.; rev. ed., p. 291.

[2] *Principles of Psychology*, vol. ii, p. 301.

we find that what is clearest about the lowest forms is organization, and what is clearest in the highest is mind. Midway then — there is a transition point in the evolutional drama where the poet glides easily over from the physical standpoint to the psychical, still, however, dealing with the facts chronologically. Then suddenly he ceases from this forward or synthetic movement, and at the close of his psychology sweeps back analytically, and, like a mighty boomerang, demolishes his first starting-point. In place of it there arises what is poetically styled "Transfigured Realism,"[1] a final tableau wherein every philosophy, from Scepticism up to Absolute Idealism, finds something to be thankful for and is anon swallowed up.

[1] See *Principles of Psychology*, pt. vii, General Analysis, last chapter.

LECTURE X

BIOLOGICAL EVOLUTION

The Lamarckian, Darwinian, and ultra-Darwinian theories generally compared. Natural selection by itself non-teleological. Attempts to assimilate the biological with the physical. Two difficulties in the way. These lead to the question: Is there not a teleological factor operative throughout biological evolution?

Teleological and non-teleological factors distinguished. Darwin recognised both. Only so far as both are present has 'struggle for existence' any meaning. The question raised equivalent to inquiring how far mind is concomitant with life. Naturalism confident that life is the wider conception, and appeals to the facts of plant-life. 'Continuity' seems to help it, but really works both ways. The case argued. The levelling-up method the simpler. Objections to this considered: (1) *Reflexes;* (2) *The character of plants again. Recent views on this point.*

Restatement of the position reached. Antagonism of organism and environment: the latter, then, not the source of life. 'Vital force' unworkable. Turning to the facts of mind we have: (1) *Self-conservation;* (2) *Subjective selection. The meaning and significance of these. Their distinctness from, and relation to, natural selection.*

In passing, as we do in this lecture, to the narrower subject of biological evolution, we find no serious attempt made to account for the origin of life or to reduce the facts of life to those of a mechanism. The problem here is merely to explain the diversity of living forms, and that not by the help of mechanical, but of biological, conceptions. The origin of species by descent from some primitive form is assumed as the starting-point.

Then we have two widely different, but not incompatible, theories, — that of Lamarck and that of C. Darwin — to shew how, as the latter puts it, "whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved."[1] The doctrine of *special* creation is, by common consent, disallowed as unscientific. This of course leaves the general question of creation untouched. Still, as respects teleological conceptions, the two dominant theories of biological evolution are by no means on the same footing. The extreme Darwinian theory, as held, for example, by Wallace or Weismann, but strongly discountenanced by Darwin himself, seems — if pressed to its logical consequences — to leave but scant space for any notions of purpose or end.[2] Natural selection works blindly upon promiscuous variations blindly produced. So mechanical is the whole *milieu* that repeated attempts have been made to extend the range of natural selection, so understood, to the evolution of stellar systems, chemical elements, and the like. Such an extension would be impossible with the Lamarckian theory, as the mere citation of the second of the four laws given in the *Histoire Naturelle* will shew: "The production of a new organ in an animal body results from a new want arising and continuing to be felt, and from the new movement which this want initiates and sustains."[3] According to Lamarck, then, variations are

[1] *Origin of Species*, sixth edition, last sentence.

[2] Cf. Romanes, *Darwin and After Darwin*, vol. ii, ch. 1.

[3] *o.c.*, edition 1815, t. i, p. 181.

due to a psychical factor; but for the theory of natural selection it is immaterial how they are produced. Given the indefinite production of varying individuals, and given also restriction in the number that can simultaneously exist, and it is obvious that some individuals must be excluded and disappear; if for no other reason, at any rate, for want of standing-room. Unless the selection is a pure affair of chance, the variations themselves must determine it: in one case — the question being one of standing-room say — the highest specific gravity, in another the lowest, might constitute the requisite fitness. So in economic exchange, wherever supply exceeds demand, such principles of selection come into play, and with one commodity cheapness is the ground of fitness, with another taste, with another novelty, with another utility in the narrower sense, and so on. Such instances bring out still further the difference between the Lamarckian and the Darwinian, or more correctly the ultra-Darwinian standpoint. For Lamarck, the fitness must relate primarily and essentially to the competing individual; for Wallace or Weismann it might primarily and essentially relate to the selecting agency. Thus in sorting shot those pellets are selected that roll down an incline quickest; in sorting emery powder those particles are selected that take longest to sink in water. In short, for the ultra-Darwinian view, life need imply no more than the indefinite production of varying individuals. Struggle for Existence here becomes simply a figure of speech, not the stern reality first depicted by Malthus, to whom, I believe, the phrase is due. In the *Origin of Species* Darwin himself calls

attention to this: "I should premise," he says, "that I use this term in a large and metaphorical sense."[1]

A similar remark applies to the phrase Natural Selection. As to this let me quote from a letter of Wallace to Darwin (*Life*, ii, p. 46). He writes: "The term 'survival of the fittest' is the plain expression of the fact; 'natural selection' is a metaphorical expression of it, and to a certain degree indirect and incorrect, since . . . Nature . . . does not so much select special varieties as exterminate the most unfavourable ones." But even 'survival of the fittest' is *not* a plain expression of what logically follows from the ultra-Darwinian premisses. The notion of fitness is used just as metaphorically as that of struggle or selection, for fitness is in strict propriety a teleological conception, and there is nothing teleological in those premisses. There is only what Mr. Spencer would call equilibration: neither struggle for life, nor selection by nature, nor survival of the best, but simply conservation of the stablest;* as in a mass of chemical elements capable of combining, compositions, double decompositions, neutralisations, expulsions go on, stronger affinities and avidities overcoming weaker, till the stablest and most permanent combinations are reached.

The mechanical theory of evolution, indeed, is, as we have seen, bent on assimilating the biological to the chemical in some such fashion. But in the way there are two difficulties. In the first place, if we look broadly at the world of living things and compare it with the inanimate world, we are at once confronted by a striking difference. In the latter we note a gen-

[1] *Origin*, 6th ed., p. 50.

* See Note xii, p. 600.

eral downward trend, the resolution of potential energy into kinetic, and then of available forms of this into unavailable; in other words, we find a uniform tendency to pass in the shortest and easiest way to physical quiescence, fixity, and equilibrium. But in the organic world, on the contrary, we find a steadily increasing differentiation of structure and composition, entailing a large storage of potential energy. We see this as we advance from plants to animals, from invertebrate to vertebrate, from cold-blooded vertebrates to warm-blooded, from brutes to man. And if we take into account what may be regarded as the by-products of living things, — their stores of food, the snares they make, the habitations they build, — the same characteristics are still present, notably so, of course, in the products of human skill. The inorganic world has nothing to match dynamite, Liebig's Extract, a steam-engine, or a ship-torpedo. It is impossible in the present state of our knowledge to bring such results under the *facilis descensus* principle of least resistance, which dispenses with all conception of guidance and direction, and can give no meaning to adaptation, fitness, or worth. And, as has been urged in earlier lectures, it seems absurd to attempt ever to refer those results to such a source, unless they can at the same time be regarded as rare and exceptional manifestations of that principle when working on a very vast scale.

The second of the difficulties mentioned runs parallel to the first; it is, in fact, this advancing complexity regarded psychologically. Here we are only sure of the latest term of the series; how the earliest terms are

constituted we can only vaguely guess. In the case of man and the higher animals, there is no doubt that the instinct of self-preservation and the struggle for existence are realities; no doubt, that needs and wants lead to movements; or that improvement comes only by repetition and effort, that practice makes perfect. The only doubt is whether what is thus acquired in one generation becomes in any measure the inborn heritage of the next; but with this burning question we are not for the moment concerned. We have only to demand recognition of the truth that in this advancing psychical complexity, at any rate, the teleological character of the facts is unmistakable; no other conception is adequate. Thus there arises this question which is for us the important one: Is not this teleological factor operative throughout the whole range of biological evolution at least; so far, that is, as we find the downhill trend distinctive of the inanimate world to be counterworked?

As a preliminary to the discussion of this question, it will be well to define a little more exactly what is to be understood by the phrase 'teleological factor,' and to distinguish it from the other factors implied. If Lamarck had happened to ask himself: How the leopard came by its spots, as well as how the giraffe acquired its long neck, it is very unlikely that he would have ventured to give the same explanation of both. Continued use in stretching might have enabled the giraffe to add a cubit to his stature, a continued use to which the need of food might lead; but use or need could hardly help the leopard to change its skin,

even though the change should facilitate the capture of its prey. A more probable explanation here is the purely Darwinian one, that skin-colouration being specially liable to vary, a variation simulating the play of sunshine through foliage had favoured the ancestors of the leopard when lying in wait to pounce upon their spoil; and that such variation had been perfected by natural selection. At any rate, though not forgetting much striking evidence of a functional and more or less voluntary connexion between an animal's colour and its immediate surroundings, we may fairly take the leopard's spots, the tiger's stripes, or the lion's tawny hue, as instances of fortuitous or non-teleological[1] adaptation. Another factor that may be classed as non-teleological, though it is one of minor importance, is that described by Darwin as "the direct action of external conditions," such as climate and food. This is the factor on which Buffon laid stress, and to which Buckle and the materialists are fond of appealing, an appeal culminating in the *mot* of Moleschott, *Der Mensch ist was er isst.* In contrast to these factors of biological evolution, then, the meaning of what I have proposed to call the teleological factors will become clearer. Among these I think we might enumerate three. First, the Lamarckian principle already referred to, secondly, Darwin's Sexual Selection, and lastly, Human Selection, on which Wallace has the merit of laying especial stress.[2]

[1] Non-teleological, that is, within the range of strictly biological ideas.

[2] I refer, of course, to his contention that the moral and intellectual nature of man cannot be explained by natural selection. See his *Darwinism*, ch. xv.

The name of Lamarck has been so long in disrepute that it would be rash to cite any theory of his, if there were not at length among biologists a manifest reversion in his favour. Opposed to the neo-Darwinians who profess to see in natural selection far more than ever Darwin publicly[1] claimed for it, there is also a numerous neo-Lamarckian school, who replace the fanciful illustrations that served to discredit Lamarck's speculation by an imposing array of facts in its support.* Such materials were not in existence in Lamarck's day; and from the free use of what material there was, he seems to have been cut off, partly by blindness and partly by poverty. It was thus easy for Cuvier, that master of details, to turn the laugh against poor Lamarck, and as the favourite of Napoleon, to use his political influence against "the transformists," as the Lamarckians were called.[2] So it came about that when Darwin was working out his *Origin of Species*, Lamarck's doctrines were in general discredit, and yet had never received an impartial hearing. Darwin's letters shew his anxiety lest these doctrines should be identified with his own. "Heaven forfend me," he wrote to Hooker in 1844, "from Lamarck[ian] nonsense of a 'tendency to progression,'[3] 'adaptations from the slow willing of animals, etc.' But the conclusions I am led to are not widely different from his; though the views of change are wholly so." Nevertheless, as time went

[1] Cf. Osborn, *From the Greeks to Darwin: an Outline of the Development of the Evolution Idea*, 1895, p. 236.

[2] Cf. Osborn, *op. cit.*, p. 196.

[3] Which, by the way, it would seem Lamarck did not hold. Cf. Osborn, *op. cit.*, p. 237.

* See Note xiii, p. 600.

on, Darwin was led by his own further studies and observations to include the Lamarckian factor among his 'views of change.' As Romanes has said: "The longer he (Darwin) lived . . . the less exclusive was the *rôle* which he assigned to natural selection, and the more importance did he attribute to the supplementary factors." Thus, to quote one instance: in the conclusion to his last edition of the *Origin*, Darwin protests against those who have misrepresented him as attributing the modification of species exclusively to natural selection, and expressly refers to it as "aided in an important manner by the inherited effects of the use and disuse of parts,"[1] *i.e.* by what is commonly called the Lamarckian factor. There is then after all no imprudence in citing this principle.

In calling this factor teleological there is, of course, no intention of connecting it with the old view that each species was immediately designed and directly fashioned to occupy a fixed place in a supposed 'plan of creation.' As already said, Lamarck, equally with Darwin, assumed the evolution of all species from a common source. I call this factor teleological, simply, then, on the ground that it presupposes conscious, or at least sentient, activity directed to the satisfaction of needs, appetites, or desires; psychical activity, in a word, as distinct from physical passivity and inertness. It implies an impulse towards self-maintenance and betterment, which so far become ends. Only where such conceptions are applicable, is there any meaning in talking of struggles to survive, or in saying, as Darwin

[1] *Origin of Species*, sixth edition, p. 421.

does, that "Natural selection acts solely by and for the good of each."[1] Sexual selection, and still more obviously human selection, can be brought under the same head, and call here for no further notice.

And now we may take up again the question: Is this same teleological factor operative throughout the whole range of biological evolution, or is it confined to those higher forms of life which have some obvious resemblance to our own? The question is one that seems to have important bearings on our main inquiry, as I shall hope to shew later on. Broadly put, the question is, How far is mind concomitant with life? With this question neither Lamarck nor Darwin has dealt explicitly; in fact biologists as such, for the most part, ignore it. But naturalism, of course, confidently assumes that life is the wider conception, that mind is but an occasional accompaniment of organization and is certainly never a cause of it; just as it confidently assumes organization to be but a special arrangement of inert masses and the effect of mechanical forces. Perhaps, however, on closer inspection, life, so regarded, may prove as insoluble a riddle as mind, so regarded, is likely to prove. Comparing the lower forms of life with the higher, it is at once obvious that the non-teleological factors seem more exclusively the efficient ones the lower down the scale we go, while the teleological factors come more clearly into play the higher we ascend. It is true that even plants respire, imbibe, and assimilate; and that among all but the lowest, as among all but the lowest animals, there are

[1] *Ibid.*, p. 162.

differences of sex. "Still," it may be replied, "only poets talk of 'the loves of the plants'; science has no ground for ascribing to them activities determined by hunger and thirst, or other organic needs. And yet how impressively diverse and complex are the developments to which, by the operation of the non-teleological factors, the vegetable kingdom has attained. The apparatus by which the bee orchis or the garden sage secures the aid of insects in its fertilisation, or that by which the crane's-bill or the thistle scatters its seed, exceed in ingenuity the snares of the spider or the ant-lion, are comparable indeed even with human devices like the parachute or the sling. Such instances, too, it must be remembered, are not the exception, but the rule, in the economy of plants, and whole libraries might be devoted to their description. Such marvels of organization"—it may be argued—"has natural selection accomplished by steadily eliminating unpropitious variations, entirely unaided by any sort of spontaneous impulse, sentient preference, or organic memory,—to say nothing of conceptions so mystical as the entelechies[1] of Aristotle, the *nisus formativus* of later writers, and other notions equally transcendental. If, then, nature alone can advance thus far before psychical phenomena appear at all, why suppose, when these are present, that they are more than concomitant, why attribute to them any share in the organizing processes? At every step in the genealogical succession both of plant and animal the germ is built anew into the parental form by a like inevitable process:

[1] The mysticism now commonly associated with this conception seems mainly due to the neo-Platonists and the Scholastics.

the acorn is here not more passive than the egg; in each alike the embryo recapitulates the stages by which it has been evolved. Why then suppose psychical factors to be necessary to the one result, when they are dispensed with in the other? It is much like saying that though the coiled spring works the meat-jack, we must suppose a musical box to be worked by the tune it plays."

Such language, I think, fairly represents the levelling-down method to which naturalism is led. For this method it claims the advantages of clearness and simplicity; on the ground, as urged by Huxley, that by thus extending the range of matter and law, it is enabled to substitute the verifiable for the unverifiable, to replace, by a single objective standpoint, subjective standpoints that may be innumerable. To the psychophysical doctrines in which it culminates, I shall have to ask your attention in the next part. In common with other attempts to make lower categories take the place of higher ones — striking instances of which we have discovered in the exposition of Mr. Spencer — this procedure gains greatly in verisimilitude by the use it can make of the principle of continuity, that cardinal principle of all theories of evolution. But it should not be forgotten that on the levelling-up method the principle of continuity is equally available. The scale of life is just as continuous from Man to the *Protista* as it is from the *Protista* to Man. To understand human actions we have to take account of mind; on the one method, then, we carry back this conception of mental determination, our teleological factor in other words, as far as we can. In so doing, we may claim to be describing the unknown

in terms of the known. Imagination, it is true, will not enable us to depict what Huxley would call the *psychoses* of creatures so far beneath us. But that alone does not invalidate the conception; if it did, a good many scientific ideas would become illegitimate. On the other hand, the levelling-down method has always more or less definite pictures to offer of the structure and movements, as also of the phylogeny and the ontogeny of each new member in any series of living forms, as it follows forward the continuous interaction of variants and environment. But then comes the difficulty, which led us first of all to inquire whether teleological factors were not throughout indispensable.

Now, even if we were to grant the theory of psychophysical parallelism, this would not justify us in saying that life is a wider fact than mind. On the contrary, simple forms of life might correspond to equally simple forms of mind. We have allowed that the psychologist is here at a disadvantage just as the biologist, or rather the physiologist, is correspondingly at a disadvantage, at the opposite extreme. We cannot certainly discern or imagine the mental states of creatures whose entire organism consists of a single cell. But even the biologist in such a case is found to infer much greater complexity of structure than ever the microscope will enable him to see; the psychologist then is equally entitled to infer the presence of appropriate mental concomitants in these unicellular organisms, if the facts of life as a whole are made clearer by so doing. I have only time to deal here with such general considerations, but, in truth, the more the protoplasmic

movements, even of the lowest plants, are studied, the more they are found to resemble actions determined by stimuli and to deviate from the mechanical motions of inert masses.* To such studies we owe in large measure what its opponents regard as a recrudescence of superstition, and its upholders call '*neo-vitalism.*' However, without discussing detailed observations, the serious difficulty just now mentioned as besetting the levelling-down method is — to say the least — greatly simplified by the opposite method, which assumes that mind is everywhere coincident with life. That tendency to disturb existing equilibria, to reverse the dissipative processes which prevail throughout the inanimate world, to store and build up where they are ever scattering and pulling down; the tendency to conserve individual existence against antagonistic forces, to grow and to progress, not inertly taking the easiest way, but seemingly striving for the best, retaining every vantage secured and working for new ones, — this complex characteristic of all forms of life belongs also to mind. Correlated with mind these characteristics are intelligible; but to interpret them literally in terms of physical interaction, and apart from mind, is surely impossible. However we resolve the problem as to the connexion of mind and matter, it is then, we may conclude, unquestionably a simplification to infer that wherever a material system is organised for self-maintenance, growth, and reproduction, as an individual in touch with an environment, that system has a psychical as well as a material aspect.

There is one very plausible doctrine not uncommon among psychologists and countenanced, as we should

* See Note xiv, p. 602.

expect, by Mr. Herbert Spencer, that stands in the way of this view. Mr. Spencer, as we have seen, imagines consciousness to arise when physiological processes become too complex to work automatically. Up to that point the reactions of the organism are simply reflexes, beyond it they are volitions: and since we are usually unconscious of reflex movements, and since, moreover, they are usually beyond our control, it is concluded that reflexes only indicate life but do *not* implicate mind. But looked at more closely, this conclusion is at variance with the principle of continuity, that fundamental axiom of evolutional theory; and it is besides, as I have urged at length elsewhere,[1] not really borne out by empirical psychology. Reflex movements are called mechanical or automatic, because of the uniformity, promptness, and precision with which they occur. None the less, even the simplest of them depend on the exact adjustment of structures often very complicated. Accordingly the biologist makes large drafts on time and appeals freely to natural selection to account for their ultimate perfection. But during all this time the various more or less abortive attempts thus leading up to an eventual automatic regularity ought, on Mr. Spencer's theory, to be accompanied by consciousness. Moreover, when we turn to our own experience, this is precisely what we find in all those cases where long practice makes perfect, and where feats of dexterity and the like become, as psychologists say, secondarily-automatic.

Another seeming hindrance to the view I am attempting

[1] *Encyclopædia Britannica*, article *Psychology*, pp. 42 f.

to propound and defend, is the one I was just now referring to, viz. the character of plants. But strangely enough this difficulty has been in the main removed by the biologists themselves. For it would hardly be going too far to say that Aristotle's conception of a plant-soul, though it would be expressed in other language, is tenable even to-day, at least as tenable as any such notion can be at a time when souls are out of fashion. The popular idea of the three natural kingdoms, mineral, vegetable, animal — plants developing from minerals, and animals from plants, as represented by the ingenious device on the covers of Mr. Spencer's volumes — has been long abandoned. If such tripartite division is retained at all, the animal it would seem should rather precede than follow the plant. For the earliest stages of plant development resemble those of animal development, though according to all the rules of evolutional propriety the converse would hold, if plants were first in order. But modern biology, as I understand, assigns the first place in the organic world to a kingdom of *Protista*, living things, that is, from which individuals with the definite characteristics of plants and animals were afterwards differentiated. The *Protista* display in a marked degree the motility and sensibility specially associated with animal life. Certain of these freely-moving creatures are supposed to have assumed a sessile position on the earth, and so to have become plants or earth-parasites, as such developing their capacity to build up protoplasm direct from its mineral constituents, but degenerating in respect of their distinctively animal traits, in consequence of their fixity of habitat. The distinctively animal kingdom, on the other

hand, it is conjectured, began with the first protist, who anticipated by untold ages the feat of little Jack Horner, and did what animals have been doing ever since — appropriated and devoured the ready-made protoplasm. "The easy nutrition which ensued," says Professor Cope, "was probably pleasurable, and once enjoyed was repeated and soon became a habit. The excess of energy thus saved from the laborious process of making protoplasm was available as the vehicle of consciousness and motion."[1] But all such conjectures aside — it is at any rate certain that plant protoplasm and animal protoplasm are essentially one and the same; that the animal functions of motility and sensibility pertain to all protoplasm as truly as the vegetable function of assimilation and reproduction; that from unicellular organisms, the *Protista*, leading the free-swimming life of animalcules and yet endowed with the plant's power of transforming inorganic matter, there arose both unicellular organisms, the *Protozoa*, retaining and developing the former characteristics; and also unicellular organisms, the *Protophyta*, with the antithetic traits; and finally that from the *Protozoa* and *Protophyta* respectively all the more complex animal and vegetable organisms have been evolved.

Let me now try by way of recapitulation to explain in what sense I understand mind in thus concluding that it is always implicated in life, or that, in other words, a teleological factor, analogous to that of Lamarck, is operative and essential throughout all biological evolution. Let us begin with the opposition of the living individual, or organism, and its environment. These

[1] *Primary Factors of Organic Evolution*, 1896, p. 514.

terms are, in biology, strictly correlative, just as in psychology the terms subject and object are. This correlation is one that only appears with life; the physicist never gets beyond the action and reaction of bodies that are not properly individuals. On looking at this relation of organism and environment more closely, we discover that it is essentially an antagonism. Whether living or dead, the organism is equally a material system, and its *death* makes no change in what we may call the attitude of the environment. What this attitude is, is therefore shewn by the processes that then ensue. These processes, one and all, belong to the downhill trend characteristic of inorganic changes; adopting, but somewhat extending, a convenient physiological term, they are *katabolic*. Imagine an organism reduced at length by these processes to a formless aggregate of its elemental constituents. Now imagine this formless aggregate of dead material led back step by step until a living organism is set up once more, and you realize the antagonism between organism and environment. For the processes of organization that preceded death were the precise opposite of all that follow it; they reversed the dissipative tendency of inanimate matter; in a word, they were uphill processes of guidance and direction — were *anabolic*.

The actual relation of a given organism to its environment is usually very complex, the environment in large measure consisting of other organisms. But we shall not go wrong, if, for simplicity's sake, we consider only the physical environment, which is indeed the sole environment of organic life taken as a whole. So doing we see the hopelessness of regarding this environment — which

itself is not alive, which antagonises life — as possibly itself the source of life. Neither can we assume a specific vital energy or force, as the old vitalists did; for life has not — so far as we can see — the properties of a definite form of energy. Thus, when life disappears, there is no equivalent amount of other energy appearing in its place, which we might regard as the result of its transformation. We cannot call death a form of energy. Life, in short, seems to consist in the guidance and control of the known forms of energy, molar and molecular. Quite possibly, beside them, there may be unknown forms of energy, but hardly, as commonly understood, such as would explain life itself. For energy — unless there be what might be vaguely called higher forms of it — is directionless, and all physical forces, so to say, katabolic. The progress of knowledge, in fine, discourages all attempts to treat life as a sort of *tertium quid*, mediating between matter and mind. Turning then to the facts of mind, a sound method will lead us first to the daylight of our own conscious experience, not to the glimmering twilight of primitive sentience and instinct. Looking broadly at the facts of mind from this standpoint, we come upon two principles that lead us straight to the teleological factors of organic evolution. One of these is the principle of self-conservation — the wide reach and significance of which Spinoza was one of the first to see;[1] the other is a principle which I ventured many years ago to call the principle of subjective or hedonic selection.[2] These principles furnish natural selection with

[1] Cf. *Spinoza, his Life and Philosophy*, by Sir F. Pollock, pp. 221 ff.

[2] Art, *Psychology*, *Encyclopædia Britannica*, 11th ed., vol. xxii, p. 552.

the ποῦ στῶ it seems to demand. Without these it is difficult to see what purchase it can have, as I will try to shew presently. But first, a word concerning the principles themselves.

I do not need to weary you with any laboured psychological analysis. It is enough to note that both these principles imply feeling and activity; they imply, too, that the activity is prompted by the feeling. Thus, self-conservation, *i.e.* the conservation of self by self, presupposes the will to live and the pain of dying. It shews itself especially, any unfavourable change in the environment having occurred, in the reactions to this change, which frequently so much exceed the energy of the occasioning stimulus. Apropos of this, organisms are often compared to delicate machinery provided with 'self-regulating' valves, with hair-triggers, and with other devices, for nicely controlling large stores of potential energy or setting it free on slight provocation. No doubt there are many points of analogy between organisms and such ingenious contrivances. But it is forgotten that the said contrivances are themselves invariably the work of mind. Call an organism a machine by all means, if you like; but where is the mind that made it, and I may add, that works it? Descartes, it will be remembered, was content to regard all the lower animals as simply automatic machines, comparable, though superior, to the marionette dancers and flute-players that were made afterwards by Vaucanson, and prompted Lamettrie to call even man a machine. But Descartes himself stopped short of this, on the ground that the complexity of human

manifestations points to what Huxley has since called a conscious, as distinct from a mechanical, automatism. But the inconsequence of Descartes' reasoning has been generally allowed. It was open to him either to refer the greater variety of human life to the great complexity of the human brain, or knowing by direct experience that the human machine was a *conscious* automaton to infer that the simpler machineries of the lower organisms were conscious automata of a simpler type. The explanation of Descartes' inconsistent and illogical doctrine is to be found in the perplexities of the psychophysical problem, with which we shall have next to deal. Led by his fundamental analysis to insist on the complete disparateness of matter and mind, and led, therefore, to reject such hybrid notions as vital force, he saw no way of explaining the interaction of body and mind save by miracle,[1] and naturally was averse to admitting such intervention any further than facts compelled him. His own consciousness, he thought, convinced him that man was a '*mélange confus*' of

[1] I do not mean that Descartes regarded the union of body and mind in man as continuously maintained by special Divine intervention. His followers were, but he was not, an occasionalist, in spite of Hamilton's contentions to the contrary (edition of Reid, p. 961). This union was for Descartes only 'hyperphysical' in the sense of being a unique fact, a 'negative instance,' as Kuno Fischer aptly calls it. The following extract from a letter of Descartes to Arnauld seems decisive: Que l'esprit qui est incorporel puisse faire mouvoir le corps, il n'y a ni raisonnement, ni comparaison tirée des autre choses qui nous le puisse apprendre, mais néanmoins nous n'en pouvons douter, puisque des expériences trop certaines et trop évidentes nous le font connaitre tous les jours manifestement. Et il faut bien prendre garde que cela est une des choses qui sont connues par elle-mêmes, et que nous obscurcissons toutes les fois que nous voulons les expliquer par d'autres. *Œuvres*, Cousin's edition, x, p. 161.

body and soul; he did not feel forced to say the same of animals or of plants. But if we admit the inconsequence of Descartes' restriction of this concomitance of psychical and physical to man alone among animals; and if we admit, too, the invalidity of treating life as a specific form of energy, — then surely we are bound to assume this concomitance wherever we recognise life. To make my meaning clearer, let me first quote a sentence or two from an essay by a very distinguished botanist, and add one or two comments. The essay is by Professor Strasburger, of Jena, and his subject is *Protoplasm and Sensibility.* Referring to the analogy between organisation and machinery, he remarks: "For the structure of a machine, too, might be called its organization; and the fact that, when provided with a store of energy, it can be started, by the opening of a valve, to perform work conformable to its structure — this property might be called its sensibility. But the living substance is entirely distinguished from the dead machine by the ability to provide itself with the energy needful for its work; to set itself in motion and keep itself going; to repair itself, within certain limits, the defects that may arise; and, above all, by the fact that it constructs itself. *In short, an organism — in contrast to the dead machine — is a living machine,* one that does not depend on external impulses for its movements, one that regulates its own course and continues going, as long as the environment will allow. Only through the hostility of this or through irreparable misfortune is it brought to a halt."[1] Now, I have said, that wherever we

[1] *Das Protoplasma und die Reizbarkeit,* 1891, pp. 24 f.

see a machine, we ask, Where is the mind that made it, and that works it? In the dead machine this mind is outside and independent; in the living machine, or organism, it is 'inside,' and so far identical. Living machine and conscious automaton are, then, strictly synonymous: whether we say life or whether we say consciousness, we equally imply the development and conservation of self by self through processes working counter to the downhill trend of the physical environment. Looking again at the dead machine, we may ask, What is it made for; what is the work that it is constructed to perform? To crush quartz, roll lead, grind flour, and so on, we are told, as the case may be. But what is the living machine made for? We must answer, be it plant, be it animal, be it man: For itself and for its kind, to live and to multiply. Once more, looking at the dead machine, we find the structure precedes and wholly determines the function; but in the organism, and especially when we take an ascending series of organisms into account, we find it truer to say the function, *i.e.* life, determines the structure.

And so we come to our second principle, that of subjective or hedonic selection.[1] By way simply of illustrating this principle, and deferring meantime all question of its evolutional significance, let me try briefly

[1] There is, I now find, some considerable resemblance between this principle and one that was set forth some ten years later by Professors Lloyd Morgan, Osborn, and Baldwin, and on which the last mentioned has conferred the very ambiguous title of Organic Selection. A clear account of this theory will be found in two Appendices, A and B, of Professor Baldwin's *Development and Evolution*, 1902 (pp. 335-371), consisting of extracts from the writings of its first propounders and others who have since adopted it. See Note xv, p. 602.

to call up two or three examples. Take the passengers on a coach going through some glen here in Scotland: in one sense the glen is the same for them all, their common environment for the time being. But one, an artist, will single out subjects to sketch; another, an angler, will see likely pools for fish; the third, a geologist, will detect raised beaches, glacial striation, or perched blocks. Turn a miscellaneous lot of birds into a garden; a flycatcher will at once be intent on the gnats, a bullfinch on the pease, a thrush on the worms and snails. Scatter a mixture of seeds evenly over a diversified piece of country; heath and cistus will spring up in the dry, flags and rushes in the marshy, ground; violets and ferns in the shady hollows, gorse and broom on the hilltops. I am aware, of course, that thrushes and flycatchers, flags and heather, are products in large measure of natural selection, that is of what we have agreed to call a non-teleological factor. But I do not think this will be found to militate against these examples for my purpose. The complete unravelling of the two sets of factors, teleological and non-teleological, so as clearly to exhibit their respective shares in any given form is probably an impossible task. My concern is only to show that the two sets of factors are there, and that the teleological are indispensable. It will suffice then to observe that by the principle of subjective selection special environments are singled out by different individuals from the general environment common to all, and that so far there is not necessarily any competition. Two artists or two anglers may be in each other's way, but an artist and an angler will hardly incommode each

other. A garden would still interest a flycatcher if there were neither pease nor cherries in it, provided the insects remained; whereas the bullfinch would at once forsake it. Natural selection as distinct from subjective selection comes into play only when two anglers contend for the same fish, two artists compete for the same prizes, when the early bird gets the worm that the later one must go without.

Let us next put this principle into shape and then we may consider its evolutional significance. Psychologically regarded, movements are determined by feeling: indifferent sensations, therefore, that occasion no feeling, lead to no movement in response; while the same presentation, if it occasion opposite feelings in two different individuals, will be followed by contrary movements. As I have put it elsewhere: "The twilight that sends the hen to roost sets the fox to prowl, and the lion's roar which gathers the jackals scatters the sheep. Such diversity in the movements, although the sensory presentations are similar, is due," then, to the fact "that, out of all the manifold changes of sensory presentation which a given individual experiences, only a few are the occasion of such decided feeling as to become objects of possible appetite or aversion."[1] So we may formulate our principle; which granted, certain important consequences follow deductively when we connect it with well-known psychological laws. Specialisation means also concentration; the more restricted the lines of reaction, the more perfect these reactions become. The "Jack of all trades is master of none." Thus sub-

[1] *Encyclopædia Britannica*, article *Psychology*. p. 552.

jective selection will determine definite variations as distinct from fortuitous ones, definite in the sense of bringing the individual into closer *rapport* with that portion of the general environment which it is selecting.

And now let us reflect how much these principles mean. Natural selection, it is allowed, is metaphorical. The common environment is not an agent, and selects as little as it conserves. Its tendency, if we consider it alone, is not to produce variations any more than to produce life; on the contrary, its tendency is towards uniformity and quiescence, as we may see in the dust and ashes to which in the end it reduces all. But in subjective selection there is nothing metaphorical; the agent here — so at least we must say as psychologists — is real, the source and type of all our conceptions of activity. I do not forget the psychophysical inquiry still pending; but that in any case has to accept psychological facts, being merely a theory about them. The agent then is real, not an abstraction; the selection likewise is real, not metaphorical. The individual positively selects what is pleasant, that is what conserves, for appetition; and negatively selects what is painful, and so detrimental, for aversion. To the remainder it is indifferent. By such selection is constituted its proper and *specific* environment. The origin of this kind of species, species of environments, at any rate seems due to a psychical, not to a physical, selection. Moreover, there is so far no struggle for existence, where "all subsists by elemental strife": rather here, as the same poet has said, "All nature's difference keeps all nature's peace."[1]

[1] Pope, *Essay on Man*, i, 169; iv, 56.

So far we may get by connecting our principles with the well-known psychological law, that concentration and practice perfect functions, and the corresponding physiological law, that function perfects structure. But there is another psychological generalisation with which I think we may connect them, and which imparts to them still further teleological significance. We have found Darwin exclaiming against "Lamarckian nonsense of a tendency to progression." But if nonsense, it is nonsense of which many great thinkers have been guilty. We find it, of course, in "the wisest of wise Greeks, the Stagirite," and in our day — spite of Darwin's disclaimer — it is still avowed by such leading biologists as Nägeli, Kölliker, and Virchow. No doubt Aristotle's conception of an internal perfecting principle was vague and lent itself to mystical interpretations. But I believe the progress of psychology will enable us some day to give it greater definiteness and a more assured foundation. Meanwhile time forbids any attempt to work further at this point now. But I will venture to quote a few sentences of my own published ten years ago, that may suffice to indicate what I mean: "How in the evolution of the animal kingdom do we suppose this advance from lower to higher forms of life to have been made? The tendency at any one moment is simply towards more life, simply growth; but this process of self-preservation imperceptibly but steadily modifies the self that is preserved. The creature is bent only on filling its skin; but in doing this as pleasantly as may be, it gets a better skin to fill, and accordingly seeks to fill it differently. Though cabbage and honey are what they were before, they have changed relatively to

the caterpillar now it has become a butterfly. So, while we are all along preferring a more pleasurable state of consciousness before a less, the content of our consciousness is continually changing; the greater pleasure still outweighs the less, but the pleasures to be weighed are either wholly different or at least are the same for us no more. What we require, then, is . . . that to advance to the level of life on which pleasure is derived from higher objects shall on the whole be more pleasurable or less painful than to remain behind."[1] Now this condition seems provided, without any need for a clear prevision of ends or any feeling after improvement or perfection as such, simply by the waning of familiar pleasures and by the zest of novelty. In the midst of plenty it is usual to become more dainty and to make efforts to secure better fare, even though the old can be had without them. Exceptionally no doubt such circumstances lead to an opposite result, as we see in the degradation of most parasitic forms. But the principle of self-conservation seems sufficient to render this result exceptional.

Thus—even if there were no natural selection of variations fortuitously occurring, and even if there were no struggle for subsistence, still—the will to live, the spontaneous restriction of each individual to so much of the common environment as evokes reaction by its hedonic effects (with the increasing adaptation and adjustment that will thus ensue), and, finally, the pursuit of betterment to which satiety urges and novelty prompts,—these conditions, really implying no more than the most rudimentary facts of mind, will account for defi-

[1] *Encyclopædia Britannica*, article *Psychology*, p. 585.

nite variations to an apparently unlimited extent. What is more, the variations so produced, even if there were no others, would furnish natural selection with an ample basis as soon as struggle for existence began. They would also remove or minimise one of the most formidable difficulties in the way of natural selection working alone — a difficulty which Mr. Herbert Spencer has had the credit of pointing out. It is easy to imagine a single variation which is at once useful, occurring fortuitously; and it is plain that natural selection will tend to maintain it. But when, as Darwin allows to be generally the case,[1] utility depends on the coördination of a number of variations separately useless, then the chances against the simultaneous occurrence of these in due correlation increase at an alarming rate as the number of independent variants increases. Proportionally large drafts on time thus become requisite before such complex utilities can arise by lucky accident. We might say, I think, that not only are geologists accused of asking more time than according to the astronomer's facts the physical history of the earth will afford them, but that the demands of ultra-Darwinians like Weismann may expose them to a like charge on the part of geologists. Weismann long ago expressed the hope that at no distant date he would be able to consider this objection — I mean the difficulty of coördinations; but, so far as I am aware, he has not yet made good his promise.*

The mention of Weismann's name reminds me that many of you will be thinking of his famous doctrines of heredity and germ-plasm. If those doctrines are true, it

[1] Cf. *Origin of Species*, sixth edition, pp. 178 *fin.*

* See Note xvi, p. 605.

will be said, acquired characters cannot be inherited, and the Lamarckian and other like teleological factors become so far impossible. As to the truth of Weismann's properly biological doctrines I have no right to express an opinion, but there are some characteristics of his method on which I may remark. *First*, 'acquired' and 'congenital' do not seem to be terms whose meaning is independently fixed. If a character turns out to be inherited, Weismann thereupon feels entitled to call it congenital, even though he had previously in common with the rest of the world regarded it as acquired. Speech, for example, is an instance which he himself selected as an acquired capability, urging that if it were congenital the human infant ought to begin by talking. When it was pointed out that it does begin by "babbling articulate syllables," the Weismannians urged, if Romanes may be trusted, that after all, "seeing of how much importance this faculty must always have been to the human species, it may very well have been a faculty which early fell under the sway of natural selection, and so it may have become congenital."[1] *Secondly*, it must be frankly admitted that in many instances in which acquired characters have been said to be inherited or might be expected to be inherited, the Weismannians have shown that nevertheless there is no such inheritance. But induction by simple enumeration is not sound logic. What the theory requires and assumes is the absolute non-inheritance of any acquired characters — a negative obviously difficult to establish. On the other hand, to overthrow the theory, it suffices if its opponents can shew that in any particular instances

[1] *Darwin and after Darwin*, vol. ii, p. 336.

acquired characters are inherited. Several such instances have been adduced, and Weismann is at this minute devoting all his ingenuity to explaining these instances away. *Lastly*, in so doing he is driven not only to modify his theory, but to render it more and more cumbrous, complicated, and artificial. The more the body-plasm is eliminated as a medium of heredity, the more wonderful and miraculous the germ-plasm becomes. 'Ids,' 'idants,' 'biophores,' 'determinants,' have an obviously teleological ring and yet are meant to make the teleological superfluous. They remind one of Mr. Spencer's speculations concerning organic evolution referred to in the last lecture; indeed, Weismann himself admits the resemblance. Yet, despite the proverb that people in glass houses should not throw stones, we have the odd spectacle of Mr. Spencer vigorously bombarding Weismann's bulwarks, quite unconscious of the fact that he is thereby seriously damaging his own. *

We seem warranted, then, in concluding, with Darwin himself, and Weismann notwithstanding, that natural selection without teleological factors is *not* adequate to account for biological evolution; and further, that such teleological factors imply not a nondescript force called vital, but a psychical something endowed with feeling and will. Finally, recalling our survey of evolution in the wider sense, we have seen that, unless the cosmos itself is to be regarded as a finite and fortuitous variation persisting in an illimitable chaos, we must refer its orderliness and meaning to an indwelling, informing Life and Mind. But the problem of the relation of Mind to Mechanism still remains.

* See Note xvii, p. 605.

PART III

THEORY OF PSYCHOPHYSICAL PARALLELISM.

LECTURE XI

VARIOUS FORMS OF THE THEORY

These theories attempt to answer the question: How are psychical changes related to the physical changes in the organism? They all start from the Cartesian doctrine of the essential disparateness and distinctness of Matter and Mind. So far they have common thought on their side; hence it is advisable to enquire first whether they are tenable even on this dualistic assumption.

What is meant by the physical series readily ascertained. But the meaning of the psychical series not so clear. It is not so much my consciousness as a unity for me as my consciousness as a series of events for the psychophysicist. Ambiguities of the phrase "parallelism" in this connexion.

(1) *Clifford's exposition of* Mind-stuff *is only Matter-stuff over again.*

(2) *The so-called* Two Aspects *theory assumes that two incompatible standpoints can be stereoscoped into one.*

(3) *The* Conscious Automaton *theory leaves the dualism untouched, and while asserting invariable concomitance tries to deny any causal connexion: the two series keep pace, but yet each "goes along by itself." On the psychical side,* sensation, *on the physical,* life, *are difficulties in the way of this theory. How they are got over. Constant parallelism* plus *absolute separation is logically so unstable a position that this theory either lapses into some form of crude monism, or one series is in the end subordinate to the other.*

Among scientific men the primacy is usually given to the material side. Huxley taken as a type. He maintains that sensation is an effect

of molecular change, but will not allow that molecular changes are ever the effect of volition. To justify this position volition has to be regarded as "feeling" or sensation simply.

Since the dawn of modern philosophy in the *Meditations* of Descartes, the question of the relation of body and mind has been continuously under discussion. The complete disparateness between thinking substance and extended substance, upon which Descartes insisted, at once brought this problem to the fore. Of philosophical attempts to transcend this dualism there has been, as we know, no lack. But the progress of science, which works forward to new distinctions rather than backward to supreme identities, has, on the other hand, only tended to widen the separation. The crude psychology, for example, that regarded extension as directly apprehended by the senses of touch and sight, is practically obsolete; so that even that vestige of naïve realism seems now to have disappeared. On the other hand, Descartes' ideal of the external world as a complete mechanism has become for many a scientific certainty. Psychology and physics, in short, have each elaborated working conceptions appropriate to their own special facts, regardless of any questions concerning their eventual coördination. Substance and cause, metaphysical notions which Descartes used in the same sense, whether referring to matter or to mind, are now discarded by physicist and psychologist alike. Mass, indeed, is still held to retain the one substantial attribute of permanence, but matter as the support of innumerable qualities and powers is no more: souls, on the other hand, as simple and indiscerptible entities are replaced

by consciousness, the so-called 'contents' of which are in continuous flux. As to cause, it is absurd to credit inert mass with efficiency, and so we have left on the physical side only quantitative relations expressed in equations of motion, and the like. In psychology the meaning to be given to causal efficiency, if any, is still in dispute. But the influence of the more perfect science here asserts itself. The notion of inherent activity, being abandoned by the physicist, is regarded with suspicion by many psychologists; for they imagine that what is held to transcend the limits of positive science in one department of knowledge must needs do so in another. In fact, the determination of this most central of all real categories, the category of efficiency, they leave depending on the solution of this very problem of psychophysics now before us. Psychical facts being meanwhile regarded as only a flux of presentations, this problem takes the form of ascertaining how the coexistences and sequences of that changing content are related to those motions of mass elements, which are held to constitute the physical world.

The answer to which 'modern science' almost inevitably leads is embodied in what is now known as the theory of Psychophysical Parallelism, or conscious automatism, as the most usual form of it is called. With this we have next to deal. This theory replaces in the creed of modern Naturalism the coarsely materialistic doctrine of a generation ago, which we have found the agnostics of our day repudiate. Disclaiming any knowledge of substance either mental or material, and disclaiming too any knowledge

of efficient causes, they hold this doctrine of parallelism to be simply a scientific inference from facts and not in any sense a speculative hypothesis. I shall try to shew that, on the contrary, it is really at variance with facts and rests upon a speculative basis of the most unstable kind, viz., the Cartesian dualism, the doctrine, *i.e.* of the complete disparateness of matter and mind. The theory of psychophysical parallelism is indeed, as it seems to me, but the scientific counterpart of that occasionalism to which the followers of Descartes were driven, in their endeavour to account for the correspondence between mental states and bodily movements. But, whereas according to the Occasionalists the Deity intervened as each occasion demanded, here the physical series is held to be mechanically predetermined and to be capable of calculation in Laplacean fashion. Thus we seem driven to infer a like rigid determination of the psychical concomitants, to admit, with Huxley, "the banishment from all regions of human thought and activity of what we call spirit and spontaneity." It is assuredly not a prepossessing doctrine; this its upholders often candidly allow. But, inasmuch as some of our ablest scientific men are counted among them, we may be sure that the arguments that have led to such a position are not to be summarily disposed of. Merely to lay bare the defects of the dualism which this parallelism presupposes is not likely to be convincing,[1] unless the theory itself can be shewn to have defects which force us to question its implicit assumptions. Such a procedure

[1] This is the topic of the fourth section of these lectures. See below, Lectures XIV ff.

is the less likely to be convincing, as this same dualism of matter and mind is engrained in common thought and speech; to this extent the doctrine of parallelism has common sense on its side. And the history of modern philosophy shows the two questions, that concerning the perception of an external world, and this concerning the relation of body and mind, to be closely connected. The whole subject is as difficult as it is important, and we are bound to study it with the utmost attention and care. When I say important, I mean important to the student of Natural Theology, for the fine saying of Henry More is assuredly true: *Nullus in microcosmo spiritus, nullus in macrocosmo Deus.*

To begin, we must make sure that we understand the main points of the doctrine itself. These may be resumed under three heads: for we have, first, a series of physical changes, the brain processes; then, a quite disparate series of psychical changes or processes, accompanying them; and finally, the relation between these declared to be purely one of concomitance, not one of interaction. As regards the physical series, it is important to remark that the only correspondences of which we have any actual knowledge are such as have been found between the physiological or pathological working of nerve tissues on the one side and conscious states and acts on the other. There is nothing in such facts taken alone — instructive and impressive though they are, as shewing the intimate connexion between body and mind — to prove that that connexion is one of parallelism and not of interaction. The specialists to whom we owe our knowledge of these facts have indeed usually been of

opinion that the connexion *is* one of interaction. The contrary opinion, then, it is to be noted, owes its rise, not to the studies of mental physiologists or pathologists, nor yet to the studies of comparative anatomists or comparative psychologists; it rests simply on the assumptions of the upholders of the mechanical theory. According to those assumptions, brain-processes, in common with all vital processes, if they could be completely and perfectly explained, would be described not as physiological, nor even as physical, processes; but simply as the mechanically connected motions of inert mass-elements. So regarded, the organic changes in brain and nerve become amenable, in principle if not in fact, to that absolute determination and fixity that characterise the ideal operations of exact mechanics. They become distinguishable but inseparable parts of an unbroken and unbreakable mechanism, every element of which is rigorously linked with every other; the whole working in perfect unison, without the possibility of deviation or individual initiative; a world that knows nothing of spontaneity, of quality, of worth, or of purpose; a world in which there is only uniformity of space and time, indestructibility of mass, and persistence of energy. There must be no secret in that world which a mathematician with sufficient data and adequate powers of calculation could not unlock; its state at any one moment, expressible in a single vast equation, must be equally the key to all its past and to all its future. Such a conception seems obviously to exclude all interference from 'without as well as from within.' In fact, there is no without or within in the case. No 'within,' for inertia excludes internal change; and no 'without,'

for, though force implies some mass external to the particular mass affected, yet, *ex hypothesi*, all the masses there are are included in the system and the system recognises nothing beyond. I do not propose to recall at this stage the results to which we were led in our earlier examination of the mechanical theory. The time to apply these will be when we enter upon the task of criticising the doctrine of parallelism. But we must first complete the statement of it.

We come, then, now to the psychical series. What are we to understand by this? Unhappily, there is no answer forthcoming comparable as respects definiteness and precision with that given concerning the physical series. For this difference there are many reasons. For one thing, quality has only been eliminated from the physical world by relegating it to the psychical; and in consequence, relations of quantity and number, which there admit of the utmost exactness, are here at best but vague and approximate. Again, when we ask after the laws determining the coexistences and successions of elements of the psychical series, we get in some cases — that of sensations, for example — no answer at all. In some cases, as in association and habit, the past, in others, as in purposive action, the future, is said to determine the present. In volition motives spring from feeling but are controlled by deliberation; so in thought, judgment is superior to association, but not to reason. How is this ultimate diversity of qualities, how are these processes so different in rank and character, to be described in terms that may run parallel with the monotonous interplay of molecules in the

cavity of a skull? But there is a further difficulty still. If this psychical series is to be my experience as it is for me, or yours as it is for you, then all those external perceptions, which are the physicists' prime data, and all the conceptions whereby they are summarised, belong to it and are the outcome of its processes. So regarded they form a unity; within this unity we find indeed a duality, that of the correlatives, subject and object, but we find no dualism of external and internal, physical and psychical, matter and mind. To come within the range of such a dualism and to justify any notion of parallelism, we must leave the properly psychological standpoint of my experience as it is for me, or your experience as it is for you. We must take up instead the standpoint of my experience as it is for you, your experience as it is for me. Then, indeed, as I am for you primarily a portion of the physical world, and you in like manner for me, it becomes natural to locate each one's experience inside his skin, his environment being outside it; to say that of the chairs and tables, moon and stars, and the rest of this external world, he has ideas; to ask the puzzling question how these ideas are produced or whereabouts inside that skin the thinking thing is; and finally, to take his body to pieces in the hope of answering the question. But this is still not the worst; for, once accustomed to speak of one's fellow-man's experience as made up of ideas in that man's head, one is led by parity of reasoning to think the same of one's own experience. And there is at least one further source of confusion still, when from concrete experiences, in which the individual

percipient is plainly recognised, has his name, place, and date, and his manifold idiosyncrasies, we pass to what is known as the scientific or objective standpoint, where the subject experiencing is entirely ignored.

Psychology is only beginning to clear itself of these confusions. I refer to them now so that we may be on our guard; for when a physicist talks about matter, he can generally provisionally define what he means. But many able men write about mind without being in the least clear what they mean. As I have already remarked, there are three related but distinct questions that are constantly playing hide and seek, especially during the occasional excursions into philosophical regions made by scientific men. These questions are the psychophysical one now before us, the psychological one concerning the intuition of an external world, and the epistemological one concerning the phenomenal and the real. We have agreed to postpone the latter questions as far as may be. It will suffice for the present if we can see that, when a psychical series is spoken of as parallel with a physical series, such psychical series is not regarded from the strictly psychological standpoint. Psychical then means not my experience as it is for me, but my experience as conceived by the physiologist studying my brain and my organs of sense and movement. As examples of the confusing influence of this point of view upon psychology proper, we have the prevalent metaphor of impressions imprinted on the mind as in Locke and Hume, the frequent identification of action with bodily movement, or the identification by certain recent psychologists of emotion with its bodily expres-

sion. One further result of this confusion is the tendency to treat consciousness atomistically, if I may so say; in other words, to regard it as owing its unity to combinations and associations of sensations, feelings, or ideas, vaguely conceived as independent elements. A glaring instance of this we have in Clifford's wild speculation concerning mind-stuff, to which I must refer presently. The essential characteristic of the psychophysical standpoint is that it implies two subjects, or — as perhaps it will be simpler to say — two percipients, whereas the psychological implies only one.

Coming next to the question: What is meant by parallelism? the answer is more uncertain still. We could readily understand the relevance of such a term if the two percipients, being psychologically similarly constituted, were both occupied with the same perceptual environment; as when, for instance, two fellow-travellers are together engrossed by the sights and sounds of a summer's day. We should also admit parallelism, if, being psychophysicists, they were both simultaneously occupied in scanning each other's brains — science having previously devised means to obviate the thickness of their skulls and the turbidity of the contents. In these cases, along with the dual series that parallelism implies, we should have also the point for point correspondence that is quite as essential. But if, while one watches 'the lark soaring and singing in the blinding sky,' the other peers into his head as he watches, where is the parallelism? "Parallels are lines that never meet," it will be said, "and so it is the complete disparateness of matter and mind that is meant. Psychological analysis, pursued

never so far, will bring us no nearer to molecular motions, and however much we lay bare the brain mechanism, thought will remain as distinct as before." No doubt; but surely parallelism is an odd metaphor to employ to express only absolute disparateness. Mental processes and material processes may resemble parallels in having no common element, but what have they answering to the point to point correspondence that parallels imply?

"*Ordo et connexio idearum idem est ac ordo et connexio rerum*"[1] is a famous proposition of Spinoza constantly quoted in this discussion; usually, I am bound to say, in entire ignorance of Spinoza's context and meaning, which to be sure is not very clear. But now, taking the words as they stand, what is an idea and what is a thing? Let me here quote a writer who has undertaken to expound such a parallelism — the late Professor Clifford: "The parallelism here meant," he says, "is a parallelism of complexity, an analogy of structure. A spoken sentence and the same sentence written are two utterly unlike things, but each of them consists of elements; the spoken sentence of the elementary sounds of the language, the written sentence of its alphabet. Now the relation between the spoken sentence and its elements is very nearly the same as the relation between the written sentence and its elements. There is a correspondence of element to element; although an elementary sound is quite a different thing from a letter of the alphabet, yet each elementary sound belongs to a certain letter or letters. And the sounds being built up together to

[1] *Ethica*, ii, 7.

form a spoken sentence, the letters are built up together *in nearly the same way*, to form the written sentence. The two complex products are as wholly unlike as the elements are, but the manner of their complication is the same. Or, as we should say in the mathematics, a sentence spoken is the same function of the elementary sounds as the same sentence written is of the corresponding letters."[1] Well, no one will question the appositeness of the term parallelism here. "Of such a nature," continues Clifford, "is the correspondence or parallelism between body and mind." But if so, then to every molecule in a man's brain there must be an answering elementary idea. Also, since according to the prevalent opinion of chemists, the seventy odd so-called elements are to be regarded as combinations of one prime atom, ideas in like manner must be regarded as combinations of one prime idea. But if the speculations of Lord Kelvin and others are to be accepted, and the prime atom itself is a state of motion in a primitive homogeneous medium, what is the mental equivalent of this primordial medium?

Again, if the elements correspond, atoms to pieces of mind-stuff, each to each, and if, further, the function is the same, there cannot be more in the one order and connexion than there is in the other. But the order and connexion of mass-elements are ultimately resolved into one kind of order and connexion, the kinetic; what now is the corresponding ultimate order among ideas? Is it associative contiguity, logical congruency, appetitive urgency, or what? The elements correspond numerically, and are, of course, simple; time is supposed

[1] *On the Nature of Things in Themselves*, *Mind*, vol. iii, p. 61.

to be common to both series: there should remain then only the question, What is the psychical analogue of space? But whatever it be, since the functions correspond, this psychical space, or quasi-space, should admit of algebraic, though not of geometrical, expression. Psychology then at length, like physics — Dr. Hicks being our prophet — may hope to become a branch of kinematics! In short, as in Clifford's illustrative instance, the sentence as sentence is the same whether spoken or written — in logical language, is one in form though diverse in matter — so here, his mind-stuff is simply the atom renamed. Allowing that it is not mind, he makes no attempt to show how from such dust a living mind could ever spring; but is content to assert that "reason, intelligence, and volition are properties of a complex made up of elements themselves not rational, not intelligent, not conscious."[1]

On one point only in this maze of psychological barbarism I will venture a remark. The assertion that new properties arise from any mere complication or conjunction of elements is never justifiable, least of all in such a case as this. Even the three lines that in a certain position we may call a triangle are so only when we introduce a fourth something we call surface, that is distinct from and independent of them as three several lines. Complexity, in truth, is a vague term even when, in the unity so described the parts precede the whole. Nobody bent on psychological precision would speak of ideas as either conscious or intelligent, but still less would he speak of ideas existing

[1] *On the Nature of Things in Themselves*, *Mind*, vol. iii, p. 67.

in isolation apart from, and prior to, a consciousness and intelligence. To such a position, however, Clifford professes to have been driven by the principle of continuity and the doctrine of evolution. Of the absurdities to which this doctrine leads as expounded by Mr. Spencer, whom Clifford seems to have followed, we have had enough already. Had he followed Leibniz instead, and applied the principle of continuity in like fashion, he could have speculated as to simple minds to his heart's content, but would never have imagined that absurdity, "a piece of mind-stuff," to which his fearless and logical interpretation of atomistic psychology had led him; he would never have imagined that the *esse intentionale* of mind, if so scholastic a term be allowed, could be described in terms that have a meaning only when applied to the complexity of material structure.

We cannot, then, it seems to me, admit such a parallelism as that offered by this crude monism of Clifford. And yet it seemed to call for notice since it is a fair type of a good deal of naturalistic speculation now in vogue. The independent advance of physics and of psychology, as I have already remarked, has revealed too clearly the entire disparity of their conceptions to leave any room for the old materialism. But the monism now in favour with many scientific men is that old materialism, to all intents and purposes, though with a new face. The problem as it presents itself to a thinker setting out from the side of matter and law, is to bring the facts of mind somehow within range. The supposed diversity and disparity of the two is the crux: hence the dualism. The assumed

impossibility of any interference with the physical scheme, except by miracle, leads next to the assertion of complete causal independence, and then the well-ascertained facts of psychophysics seem to point to a parallelism. Now, the mere existence of two independent sets of facts, taken by itself, would constitute no problem, for science at any rate. And the concomitant variations of cerebral development and function on the one hand, with mental development and function on the other, in no way excludes, and, as I have said, was never supposed to exclude, the interaction of body and mind. But the conjunction of independence and parallelism at once confronts us as a formidable problem. The ordinary canons of method allow of independence and *casual* coincidence; but independence and *invariable* coincidence seem contrary to all reason. Any hypothesis that will resolve the coincidence into identity is so far sound; but it must not tamper with the facts as Clifford's egregious travesty of mind-stuff assuredly does. Here the ideas (ejects as he calls them) become the real things or things-in-themselves; while material things become what others call ideas or mental pictures, in which mind-stuff is the thing represented. But, as the ejects stand divested of every mental characteristic, it is a puzzle, at least as great as the puzzle solved, to see how these new ideas are ever to begin. Even things-in-themselves, if they are 'not rational, not intelligent, not conscious,' can neither have the motive nor the power nor the skill to group themselves and take each other's pictures.

Another rendering of Spinoza's doctrine of parallelism

more in keeping with his philosophy, and altogether less absurd, is that familiarly known as the 'two aspects' theory. Here, as with Spinoza, mind and matter are attributes of one substance. But they are conceived not as attributes of the one substance *in itself*, as in Spinoza's definitions, not as 'ontal' attributes, but as phenomenal attributes, if I may so say. Modern thought, chary of ontological dogmatism, declines to affirm anything of such a conception as Spinoza's One Substance. But while leaving this in uncertainty, many recent writers of note have been content to account for the disparity between the psychical and physical series by diversity of standpoints. That which in one aspect appears as states of consciousness, in the other appears as matter in motion, just as a deaf man may perceive the strokes of the bell-clapper while a blind man hears the sounds from it. Once accept the deliverance of the psychologist that he does not know what mind as a substance is, and the like deliverance of the physicist as to his own ignorance of the substance of matter, and it becomes an obvious superfluity to have *two* unknown substances. Especially so, when one — for those who cannot do without any — and best of all, an unknowable one, will amply fill any gulf that is phenomenally impassable. So we find the very men who are loudest in their denunciation of metaphysical speculation complacently preaching this two aspects doctrine. For, after all, what objection can an agnostic have to an unknowable substance? But it is possible, I think, without trespassing into metaphysics to shew that the double aspects theory is not fundamentally tenable.

Like much psychophysical speculation, it rests upon a faulty and exploded psychology and fails largely through its free use of metaphor to get really to the bottom of the situation. The notion, countenanced by Locke and also by Kant, that the facts of mind are perceived by an inner sense and the facts of matter by the outer senses, breaks down before a more careful analysis. Even if this distinction were sound, still what I am supposed to experience through internal perception is not another aspect of what I perceived externally; nor again is my experience, taken as a whole, another side of that abstract conceptual scheme by which the naturalist would describe the physical processes of my brain. When the normal man combines in himself the separate perceptions of the blind and deaf, the movement seen by the one, the tones heard by the other, he refers them both to one thing, the bell, as its states or 'aspects.' But now we never do this with our so-called internal and external perceptions. If we did, then so far the two-fold aspect doctrine would be justified and dualism might be avoided. Again, when two percipients observe different sides of the same thing, like the hasty knights in the fable of the shield, they can—as the knights did—change places and each connect the two aspects in one experience of an object. In short the phrase 'two-sided' is a phrase merely, unless it is possible in such manner to pass continuously from the one side to the other, from outer to inner or from inner to outer. The whole psychophysical problem turns on the fact that this cannot be done. To give any meaning to this metaphor of sides or aspects, it should be possible to indicate in some way the unity to which

they belong, and to shew that they have such congruence as befits complementary sides or aspects of the same thing. But the unity cannot be indicated; so an unknown substance is assumed.

Within the range of our experience, or of the scientific conceptions by which we formulate it, I have said no such unity is forthcoming. Let us consider this a little further. My experience is not so much *beyond* or out of the present reach of the physiologist who may con my brain: it is, as a concrete individual experience, absolutely distinct from his; and *per contra* his perception of my brain, for the very reason that it is his perception, can never be mine. This is allowed; but it is frequently urged that even if I cannot directly perceive my own brain I could conceivably observe it indirectly, as I do my face in a glass for instance. Certainly the mere fact that the reflexion and the face reflected occupy different positions in space does not seem important. Similarly it may be urged that I could conceivably have a facsimile model — if you like a working model — of my brain, which would be as accessible to my observation as my actual brain is supposed to be to the observation of the physiologist. But now the physiologist can see both the face and the reflexion; he can handle both the brain and the model. Further, he must have made the copy from his previous acquaintance with the original; I should not even know my own portrait as mine if I had not independent knowledge of other faces and their portraits. When I touch one hand with the other I have a double perception; when I touch another's hand I have only a single perception. So if I *could*

actually manipulate *my own* brain I should presumably only add to that sense of embodiment, which is referred to the psychical aspect. These experiences the model would not give and the physiologist would not have. And as to the possibility of a model, is it, I will not say a conceivable, but is it a permissible hypothesis? I refer not to the unattainable feats of workmanship such a model implies, but to the fact that if it verily were a model of a living brain it would have *its own* psychical aspect. The nearest approach we know of to such a model is that which nature makes in the production of twins; and the process there runs back through all the ages of human development. To assume the possibility of any process more direct is to assume the possibility of setting aside the existing laws of nature, that of psychophysical parallelism among the rest, if it be a law of nature.

There is, then, it would seem, no way of combining these distinct 'aspects' into one concrete experience. If we are misled into imagining that there is, it is because we confound the general knowledge of brains (which is all the physicist or physiologist really has, and which we *can* share) with the concrete knowledge implied in the notion of the physical aspect or basis of our own particular experience, which we could not possibly share. And this diversity, the concreteness of the psychical side contrasted with the abstract and conceptual character of the physical, is only one among several points in which their characters manifest an incongruity incompatible with the theory of their being complementary aspects of one unity. Thus the one

is described as inextended, the other as extended; to the one all quality is relegated, the other remaining wholly quantitative; and so on. With these points, however, we shall have to deal more fully later.

Another, and in some ways stricter, interpretation still of the phrase psychophysical parallelism goes to the opposite extreme. Instead of seeking to escape, in some way or other, from the difficulties of interaction between things so disparate, — as Descartes' immediate successors did, — those who maintain this view boldly make the impossibility of such interaction their starting-point. Whatever produces a physical change must, they contend, itself be physical; whatever produces a psychical change must itself be psychical. Though it is unquestionably the case that changes in the one region accompany changes in the other, yet their place in time is to be explained entirely by the antecedent events in their own series, not at all by the simultaneous events in the other. Their parallelism is a case of coexistence simply, not of causation in any sense. If there were interaction between matter and mind, then physics, it is said, would be incomplete without a theory of psychical action, precisely as it would be, — or perhaps I should say, is, — incomplete without a theory of electromagnetism. On the other hand, states of mind, if amenable to diverse physical influences, would have to have assignable spatial relations and configurations, and so cease to be psychical. The plane of psychology, in short, is held to be distinct *toto cælo* from the plane of physics.

It is usual to illustrate the supposed absurdity of attempting to connect the two causally in some such

fashion as in the following quotation, which I borrow from Professor James. The writer quoted asks us to imagine "an idea, say of food, producing a movement, say of carrying food to the mouth." "What," he asks, "is the method of its action? Does it assist the decomposition of the molecules of the gray matter [of the brain], or does it retard the process, or does it alter the direction in which the shocks are distributed?" Supposing a case in which the gray matter is about to "fall into simpler combinations on the impact of an incident force," he then asks: "How is the idea of food to prevent this decomposition? Manifestly," he continues, "it can do so only by increasing the force which binds the molecules together. Good! Try to imagine the idea of a beefsteak binding two molecules together. It is impossible. Equally impossible is it to imagine a similar idea loosening the attractive force between two molecules."[1] It must be allowed that we cannot picture ideas in the act of altering the chemical properties of molecules; and if illustrations of this kind are conclusive, we might at once assert, as this writer does, that mind and matter are absolutely separate. But unhappily such illustrations do not help us much. If mind and matter are absolutely separate, as separate, say, as music and minerals are, what are we to make of the invariable concomitance of a mental change with a bodily change, on which the same writer insists with equal strenuousness? "*Why* the two occur together, or what the

[1] Cf. Mercier, *The Nervous System and the Mind*, p. 9; see W. James, *Principles of Psychology*, vol. i, p. 135.

link is which connects them," he adds, "we do not know, and most authorities believe that we never shall and never can know." But, even granting this, surely such ignorance is an odd reason for asserting an absolute separateness of things thus invariably conjoined. If science had proceeded in this fashion in other cases of unexplained coexistence, it would not have made much progress. I venture again to maintain that invariable concomitance and absolute causal independence are incompatible positions; and I will add: no "authorities" have ever been able consistently to maintain both.

What these people really mean to say when they assert both parallelism and absolute separation—on the ground that like can only be produced by like—is something very different from what they seem to say, something very trivial and hardly worth saying. It amounts briefly to this, that the connexion between matter and mind cannot be a psychical connexion, and cannot therefore be expressed in psychological language; also that it cannot be a physical connexion, and therefore cannot be expressed in physical language. But since the connexion exists, there are apparently only three distinct possibilities open, possibilities, however, which are not mutually exclusive. Either, first, there must be, whether we know it or not, psychical facts not psychologically explicable, psychical events without complete psychical antecedents. Or secondly, there must be, whether known or not, physical facts without complete physical antecedents. Or thirdly, there must be an unknown something as the medium connecting and correlating the two. This last, which we may call the

speculative alternative, is that adopted in monistic interpretations such as those we have just considered. The other two may be classed together as scientific alternatives, and it is these that chiefly concern us at present.

Now on the psychological side we can at once point to a class of psychical events not psychologically explicable, viz., sensations. And on the physiological side there is certainly one fact which has so far baffled all attempts at physical explanation — I mean the fact of life itself. Here then, apart from any *a priori* considerations, we have empirical grounds for demurring to the parallelistic position "that the two things are on utterly different platforms — the physical facts going along by themselves and the mental facts going along by themselves."[1] Why sensations occur or recur, coexist together or succeed each other as they do, no psychology can explain, no psychologist has ever attempted to explain. Sensations one and all are intrusions, interferences, affections, or modifications in the 'mental series.' So far they are proof positive that that series does not altogether go along by itself. Descartes is our best teacher here. The fearful perplexities which beset him, the contradictions into which he fell, in his endeavour to account for sensation and yet maintain this utter dualism of body and mind, are only escaped by the modern naturalist because he does not face the problem as fairly as Descartes or Malebranche did. The substitution of a psychophysical for a strictly psychological standpoint has led the modern psychologist first to regard your sensations as they are for him, not as they are for you, and then to speak of

[1] Clifford, *Lectures and Essays*, vol. ii, p. 56.

them as your subjective modifications, not as your objective presentations. He imagines your consciousness as somehow located in a sort of fourth dimension, within your head.[1] Then, assuming that all the three-dimensional changes there belong to what he calls *par excellence* the objective world, the independence of this world both of you and your sensations seems manifest; and so he concludes that mental facts go along by themselves.

The difficulties on the side of the physical series suggested by the phenomena of life are escaped in a different fashion. These, as we saw in the last lecture, consist primarily in the facts of direction and selection which distinguish the movements of living things from the motions of inanimate matter. "Tendency to equilibrium of force and permanency of form," said Huxley, in a passage which he afterwards recanted, "these are the characters of that portion of the universe that does not live, the domain of the chemist and the physicist. Tendency to disturb existing equilibrium, to take on forms which succeed one another in definite cycles, is the character of the living world."[2] In other words inertia is the distinguishing mark of the one, effort of the other; to life primarily belongs that energy which is figuratively attributed to matter. The principle of least action is the crowning generalisation of physics, that of self-preservation and betterment the first law of life. So diametrically opposed are the characters of the two that our eminent physicists with scarcely an exception pro-

[1] Descartes, it will be remembered, preferred a location of no dimensions.

[2] *Lay Sermons*, 1872, p. 76, and Prefatory Letter, p. vi.

claim the problem of life to be ultraphysical. "The only contribution of dynamics to theoretical biology," says Lord Kelvin, "is absolute negation of automatic commencement or automatic maintenance of life."[1] Nevertheless, this is precisely the doctrine which biologists and physiologists for the most part maintain and believe. The difficulties to which the pure physicist is awake they seem to escape through a happy division of labour. When a machine is already made, be it clock, dynamo, or automaton, physical principles will account for its working. So to deal with organisms, *when there,* is preëminently the business of the physiologists. The main question for them is not how the machine came to be, or what it is for, but how it works. "You do not explain the working of a clock by referring to a chronometric principle, but you point to the coiled spring and to the disposition of its wheels and levers; so we," they say, "when we see a unicellular organism positively heliotropic and turning to the light, or negatively heliotropic and turning from it; we do not appeal to an occult principle of life, we regard such organism as an automaton, and seek in its construction the explanation of its response. We keep closer to the purely descriptive *rôle* of science, if we simply credit such an organism with hydrotropism or chimiotropism or thermotropism than we should do if we said that it drinks when thirsty, eats when hungry, and shrinks from the cold. And since the higher organisms are but complexes of cells, we conclude that the same methods of interpretation are legitimately ap-

[1] *Constitution of Matter*, 1889, p. 415.

plicable to them. For 'the most complex organism,' as Claude Bernard, the greatest of French physiologists, has said, 'is but a vast mechanism resulting from the assemblage of secondary mechanisms.'" Suppose we now turn round on that inept analogy of the clock with its occult chronometric principle; and, reminding our physiological friends that clocks not only do not exist for themselves, but neither make, mend, maintain, nor multiply — still less improve — themselves; suppose we ask how these secondary mechanisms come to be, and to assemble into connected mechanisms of vast complexity? Well, we are then at once sent away with an introduction to the biological specialist. He is the person whose business it is to answer that question. But we find he knows still less than the physiologist of the narrow range of the ultimate conceptions of physics, and looks at our question from quite another side. As we have previously seen, he takes the theory of evolution for the mainstay of *his* argument, regardless of the fact that progress and development are conceptions that do not admit of mechanical interpretation. He talks naïvely of protoplasm, bioplasm, germ-plasm, and the like, without ever suspecting that under cover of this figure of plasticity he is availing himself of psychological conceptions that he, equally with the physiologist, is bound to disavow.

And so,—in spite of the psychological impossibility of accounting for sensation, in spite of the emphatic declaration of the pure physicist that he cannot conceive inert, rudderless molecules, that have no insides and undergo no change, giving rise to wondrous automata that seem

afterwards to shape and direct them,—in spite of all these difficulties, the doctrine that man and the organisms beneath him are but conscious automata is made to look presentable. This is the form that the doctrine of parallelism assumes when monistic speculations as to a common substance, known or unknown, are left aside, and the axiom that disparate things cannot interact is applied to the one world of experience as sundered in twain by the Cartesian dualism. It affords quite the most impressive exhibition to be found of a fallacy to which "scientific philosophy" is especially liable — that of mistaking two halves for a whole, the fallacy again which the philosophy of science is especially bound to expose and correct.[1] If the so-called mental and material worlds were really independent and separate wholes, each going along by itself, parallelism and interaction would, I repeat, be alike inconceivable. On the other hand, if they are really members of one whole, then they cannot be severed and yet remain what they were before. To deny their interaction when so severed, on the ground that on neither side can the connecting link be found, will be true, though trivial. But on this ground of their abstract separation, to assert their causal independence is an error which the alleged parallelism at once proclaims. Constant parallelism *plus* absolute separation is, I say once again, logically so unstable a combination that of necessity one or other term must be dropped.

And now we shall find in fact that the exponents of animal automatism are continually lapsing either into

[1] Cf. Hegel, *Encyc.*, *Logik*, § 38, Zusatz.

vague monistic speculations, or subordinating the psychical series to the physical, or both. Sometimes, though more rarely, we find an author setting out by formulating parallelism with causal independence, and yet in the end subordinating the physical series to the psychical. Such an author is Wundt, who, while affirming that the action of mind on matter, if it existed, would be of the nature of miracle,[1] yet contrives to accept the Aristotelian doctrine that the soul shapes the body and to assign to voluntary impulses the *rôle* of *primum movens* in organic development.[2] But such opinions are mutually consistent only when parallelism is resolved into the almost trivial statement I have already referred to, viz. that neither from the side of psychology alone, nor from that of physics alone, is the interaction of body and mind comprehensible—a statement that is rather a methodological convention than a law of nature. It amounts to saying: Let psychologists and physicists severally attend to their own business; when they do so, their lines of work may sometimes run parallel, but will never be found to intersect. With Wundt's doctrine as a whole we have for the present no concern and certainly no quarrel.*

More serious and important is this doctrine of conscious automatism as propounded by such purely scientific writers as Huxley and Du Bois-Reymond, and here the lapse is always to the side of subordinating the psychical to the physical. In Huxley's case indeed

[1] *Ueber psychische Causalität und das Princip der psychophysischen Parallelismus, Philosophische Studien*, Bd. x, p. 33.

[2] *System der Philosophie*, 1st ed., p. 332. * See Note i, p. 606.

the leaning towards the primacy of the physical side is often so pronounced that it can hardly be called parallelism at all. Spite of his vehement repudiation of the title of materialist as an affront to his untarnished agnosticism, I know of few recent writers who on occasion better deserve the title.[1] Let me quote a passage or two from his famous Belfast Address to the British Association, *On the Hypothesis that Animals are Automata and its History*,[2] the appropriate pendant to the address given by his friend Tyndall on the same occasion. "It may be assumed then," he remarks after describing certain well-known experiments by Pflüger and Goltz, "that molecular changes in the brain are the causes of all the states of consciousness of brutes. Is there any evidence" he remarks, "that these states of consciousness may, conversely, cause those molecular changes which give rise to muscular motion?" He answers: "I see no such evidence." And presently he continues: "It is quite true that, to the best of my judgment, the argumentation which applies to brutes holds equally good of men; and, therefore, that all states of consciousness in us, as in them, are immediately caused by the molecular changes of the brain substance. It seems to me that in men, as in brutes, there is no proof that any state of consciousness is the cause of change in the motion of the matter of the organism." He tones this down somewhat by describing consciousness as related to the mechanism of the body

[1] Still, on the whole, it would be far truer to charge Huxley with inconsistency than with deliberate materialism.

[2] *Collected Essays*, vol. i, cf. pp. 239 ff.

'simply as a collateral product of its working,' but expressly declines to describe muscular motion as even a collateral product of volition. At first sight this one-sidedness seems very unreasonable, and in any case is certainly not strict parallelism. We naturally urge that it is not in itself less inconceivable how matter can act on mind than it is how mind can act on matter. The inconceivability Huxley fully admits. "How the one phenomenon causes the other," he says, "we know, as much or as little, as in any other case of causation; but we have as much right to believe that the sensation is an effect of the molecular change as we have to believe that motion is an effect of impact." But against the admission that volition causes physical changes, there is, over and above the general inconceivability of all transeunt action, a further difficulty — a difficulty that for naturalism amounts to an absolute impossibility. For naturalism sets out from, and is founded on, the mechanical theory, and that, as we have abundantly seen, postulates a complete and rigorous concatenation of all physical changes into one vast, undeviating process. 'Collateral products,' comparable to the shadow of a moving train or the sound of its whistle, it is thought — very inconsequently, by the way — may perhaps be imagined; for these at least, though they may indicate, can never influence, the working of the machinery. So regarded, the psychological distinction between sensation and response, vital though it is, sinks into nothing. The very notion of action becomes an illusion. The material series indeed goes along by itself, but the mental series only

goes along by itself as does a succession of shadows. "If these positions are well based," says Huxley, "it follows . . . that . . . the feeling we call volition is not the cause of a voluntary act, but the symbol of that state of the brain which is the immediate cause of that act."[1] How far those positions are well based we must further consider in the next lecture.

[1] *Collected Essays*, vol. i, p. 244.

LECTURE XII

THE CONSCIOUS AUTOMATON THEORY

Doctrine of Conscious Automatism or Psychical Epiphenomenalism examined. *It is maintained* (1) *that there can be no causal connexion between the psychical and the physical series, and yet* (2) *that the psychical is a 'collateral product' or* epiphenomenon *of the physical. The very statement is thus self-contradictory.*

Mind thus becomes impotent to control matter. In accepting this position Naturalism is really at variance with itself. For (1) *it elsewhere assumes that mind is an efficient factor in biological evolution, and* (2) *the physicist proper declares that the laws of matter alone will not explain life.*

However, taking the doctrine as it stands, there are these two articles specially to consider: (a) *the primacy and independence of the automaton, and* (b) *the illusory character of psychical activity. The latter to be discussed first.*

Huxley's endeavour to save himself from the charge of fatalism only results in substituting a blind necessity for a logical one. Again, he urges that we are free, "inasmuch as in many respects we can do as we like." But how so, if "volitions do not enter into the chain of causation of the action at all"? Turning now to the mechanical world, of which the automaton is a part, we find no activity within that.

There is thus activity nowhere! How then do we come to be talking of it even as illusory? And if conscious automatism is true, how is illusion or error possible? The ground on which Descartes called man a conscious *automaton — because of his intellectual and voluntary activity — is ignored by Huxley and others. On their premisses Descartes would have called man a* mere *automaton. Huxley turned against himself. The psychical series will not resolve into a series of feelings, and "volition counts for something as a condition of the course of events."*

An antinomy thus reveals itself—that of the teleological and the mechanical. The conscious automaton theory the result of the naturalist's preference for materialistic terminology. Attempts to find a half-way through loopholes within the mechanical theory turn out to be futile.

IN the preceding lecture we were occupied with a general survey and some passing comments on the doctrine of psychophysical parallelism, and the various modifications of it now in vogue. Leaving aside one form of it, admissible but unimportant, which merely announces the irrelevance and incongruity of psychological conceptions in physics and *vice versa*, we found the others result from reflexion on the intimate correspondence between mind and body, which physiological and comparative psychology now set before us. The first and most obvious inference which suggests itself to an observer confining his attention to these facts, is that mind and body mutually influence each other. Yet such an inference has failed to maintain itself in the face of the dualistic conceptions with which we one and all first approach these questions. The more psychologists and physicists elaborate their respective data in isolation, the more inconceivable psychophysical interaction becomes. Under these circumstances monistic hypotheses naturally present themselves, and to a monism of some sort we must, no doubt, in the end come. But the monism now in favour with scientific men only escapes the lesser difficulty of parallelism *and* absolute separation, by incurring others greater. For if the order and connexion of physical things be that of the mechanical theory, and if the order and connexion of ideas conforms to that of physical things,

it matters little whether we have one substance or two. Either way our ordinary common-sense conception of mental activity and initiative becomes altogether illusory. A monism that could dispense with this mechanical parallelism would be worth having. But if mind has simply to shadow the working of an automatic mechanism, it matters little whether we call it another aspect of the same substance, or a collateral effect in a distinct substance; or whether, leaving the whole question of substance aside, we call it an epiphenomenal accompaniment of physical phenomena. Agnosticism, in fact, insists that, if there are two substances, they are both unknown; but on grounds of economy acknowledges a preference for one, provided it is unknowable. In any case, the dualism of the psychical and physical series remains as Descartes left it, save that it is, if anything, still more pronounced. He is, too, in the main the author of that doctrine of animal automatism by which nowadays the relation of mind and body is said to be 'scientifically' described. This, then, is the doctrine we have specially to examine.

We have already noticed one serious ambiguity about it, on which it will be well to comment somewhat further. On the one hand this doctrine maintains, first, that there is no causal connexion between the two series and that there cannot be any; yet on the other, in the second place, it represents conscious states as collateral products of the physical series. A new ground for the first of these positions, over and above the complete disparateness of mental and material facts, is found in the doctrine of energy as mechanically understood. This is

opposed both to the outgoing of energy from the physical side as well as to the incoming of energy from the psychical side. As to the second position, that is simply a desperate attempt to save appearances in the eyes of logic. Constant coexistence and correspondence imply causal relation of some sort. The physical side will brook no interference and its processes are held to be complete in themselves; but the vague and, so to say, impalpable character of the psychical series, it is imagined, will allow us to regard it as a collateral effect, an effect that yet takes nothing from the physical energy of its cause. The figures used to describe this relation, such as the shadow of the engine, the sound of the clock-bell, the colours of a mosaic as distinct from the stones that compose it, and particularly the newly coined phrase *epiphenomenon* (or, as the Germans say, *Begleiterscheinung*), plainly indicate an endeavour to attenuate to the uttermost a connexion which after all it is impossible absolutely to deny. It is scarcely needful to dilate on the transparent inconsistency of such a position. Even shadows and sounds involve work, though possibly its amount is infinitesimal in comparison with that expended in driving the machine. And this is a point which physicists are not slow to urge when, with much more reason, it is said that mind guides the material mechanism without the expenditure of work. The physicist is not entitled to use cause in two senses. If mental states are simply products of molecular conditions, however collateral, then these products must count in with the rest. To say that consciousness is an *aura* or epiphenomenon of the organism, which

itself is but a mechanical automaton, is to shirk the difficulty, not to face it. If mental states are not simply products of material conditions, then matter must interact with something else to produce them. The clock will not sound in a vacuum nor cast shadows in the dark.

But the most serious point in this doctrine of conscious automatism is that which is also its cardinal point, the impotence of mind to influence matter. The practical consequences which logically follow are serious, but I do not now refer to these: It is true, as Huxley says with reference to them: "The only question which any wise man can ask himself, and which any honest man will ask himself, is whether a doctrine is true or false. Consequences will take care of themselves; at most their importance can only justify us in testing with extra care the reasoning process from which they result." But it is exclusively the theoretical consequences to which I propose to ask your attention with a view to this very testing of the doctrine from which they follow.

To begin then, I would observe that in this doctrine of animal automatism, naturalism is really at variance with itself. For throughout its exposition of biological evolution it assumes — though often covertly — that mind *is* an efficient factor in organisation. We have seen Mr. Spencer adroitly bringing consciousness on the scene when the complexity of the organic reflexes, which are supposed to be purely mechanical, necessitates such direction, much as a barrel organ requires some one to select and start the appropriate tune.* Again, in the theory of natural selection it is everywhere taken for granted that instincts, habits, and inclinations are factors equally as

* See Note ii, p. 606.

potent as anatomical structure or physiological process. Thus Darwin speaks of the sense of hunger and the pleasure of eating as "no doubt, first acquired in order to induce animals to eat."[1] He also thinks we may safely infer that the parental, filial, and social, affections "have been to a large extent gained through natural selection." The upholders of animal automatism, however, who make a shift to account for eating by a physical process of chimiotropism, ought to replace social impulses by various homeotropisms, and so forth. Moreover, it is not merely constant concomitance that has to be accounted for, but a constant concomitance that is teleological. As Professor James pertinently urges: "If pleasures and pains have no efficacy, one does not see (without some such *a priori* rational harmony as would be scouted by the scientific champions of the automaton theory) why the most noxious acts, such as burning, might not give thrills of delight, and the most necessary ones, such as breathing, cause agony."[2]

But not only is the automaton theory inconsistent with the doctrine of evolution as ordinarily accepted, it is also, as we have had occasion more than once to notice, inconsistent with the principles of mechanics as these are presented by their authorised exponents. Those principles will account for the working of a machine, but they will not account for the machine itself. They furnish the inventor with his means; they do not furnish him with his ends. And let it be remembered further that according to the strict naturalistic philosophy machine and

[1] *The Descent of Man*, vol. i, pp. 80 f.
[2] *Principles of Psychology*, vol. i, p. 144.

machinist alike are possible in only one way, as *lusus naturæ*, so to say; as casual and more or less exceptional results of integration of matter and concomitant dissipation of motion, to use again Mr. Spencer's formula.[1] We have from that no warrant to conclude that the cosmos is more than a lucky corner in an illimitable chaos, comparable to a single truly rounded pebble which we may chance to find on a whole beach of shapeless stones. What seems at first sight the result of intelligent guidance turns out to be but an incidental consequence of those secondary distributions of matter and motion that accompany the primary distribution. The existence of organisms regarded as automata — though mechanically as inexplicable, if we take any given organism by itself, as Paley's watch on the heath is inexplicable if there be no watchmaker — is accounted for, then, only after this haphazard method. Nevertheless, the physicist proper, confining himself to proximate causes, declares the origin of animate machines, even more than the construction of inanimate, to be a result which the mere laws of matter and energy will not explain. To set against this we have nothing but Mr. Spencer's poetic evolution of cosmic evolution, in which even the fixity of definition demanded by logic is infected by the subject matter; and all the terms, like the 'instabilities and nascencies' they describe, are in a state of perpetual μετάβασις εἰς ἀλλὸ γένος.

However, for the moment accepting this result as part and parcel of the naturalistic scheme, let us see how

[1] This, by the way, is very ancient doctrine. It is carried out fearlessly to its remotest consequences by Lucretius. Cf. *De Rerum Natura*, bk. iv.

things stand. The organism is an automaton that has arisen without guidance. "What we call spirit and spontaneity," to recall Huxley's striking words, is already banished from this side. And on the other side, when we turn to the consciousness that shadows the working of this automaton, there is no real independence, and only the illusion of activity is left. Though but a collateral product, it still *is* a product; the automaton is physically independent of the consciousness that accompanies it, while the consciousness in the absence of an adequate automaton is an impossibility. We have here then two articles of the conscious automaton doctrine which we must specially consider: (1) the primacy and independence of the automaton; and, (2) the illusory character of psychical activity. I propose to defer the first of these for a while,[1] and for the present to continue the examination of the latter.

When Huxley[2] assures us that our voluntary acts are as purely mechanical as our reflex actions, and that 'volitions' simply accompany but do not enter into the chain of their causation at all, the only voluntary acts he contemplates are bodily movements. But the theory inevitably commits him to a far more extravagant position. If the motor processes, with which our voluntary consciousness is parallel, are part of the unbroken physical series, the cerebral processes that are attended by intellectual consciousness are equally parts of that physical series. If volitional activity is illusory, intellectual activity is illusory also. If voluntary movements are at bottom determined by motor reflexes, then, by parity of reasoning,

[1] Cf. below, p. 390.

[2] Cf. *Collected Essays*, vol. i, p. 241.

thought is at bottom determined by nervous connexions. *Träumen ist leicht und Denken ist schwer*, say the Germans: dreaming is easy and thinking is hard. So it seems; but nerve currents, like other physical changes, take always the line of least resistance. Only, when the resistance by the easiest line is comparatively great, the process is slower; and what we call specially thinking is but the collateral product of the friction induced. On the physical side there is no effort, and on the psychical the effort is only seeming; on the physical side there are no ends, and on the psychical, the ends do not really control the means. Logical processes become in truth but the concomitants of physiological processes, and physiological processes ultimately resolve into the integration of matter and the dissipation of motion, the steady downward trend of inert elements back again to that equilibration which sometime or other, nobody can say how or why, must have been disturbed. Once the dice have left the box every detail of their fall is entirely and absolutely determined; and what is true of them is true of every minutest movement of every minutest molecule since that first catastrophe took place. The dance of motes in a sunbeam and the dance of molecules in a brain are, in this respect, altogether on a par; though in the one case we believe there is a psychical *aura*, while in the other we say there is none. Simply and solely because these brain movements are what they are, the attendant psychical shadows, their 'collateral products,' are what they are, whether what we call strength of will or what we call moral impotence, whether pure reason or incoherent raving.

And wherefore shall we not call this fatalism? "Because," replies Huxley, "I take the conception of necessity to have a logical, and not a physical foundation."[1] This is a strange and perplexing answer and suggests many reflexions. In the first place, if our mental conditions are simply 'the symbols in consciousness of the changes that take place automatically in the organism,' then logical necessitation is like the rest. It, too, is but the shadow or symbol that actually accompanies organic changes that actually take place. Its existence is a fact, its supposed significance is an illusion, precisely as the existence of 'the states of consciousness called volitions' is a fact and their supposed efficacy an illusion. Logical necessitation is quite as important to the spiritualistic view as voluntary freedom, but the doctrine of automatism excludes both. Accordingly Huxley argues quite consistently when he says elsewhere of this idea of necessity: "It does not lie in the observed facts and has no warranty that I can discover elsewhere. For my part I utterly repudiate and anathematise the intruder. Fact I know, and Law I know; but what is this Necessity save an empty shadow of my mind's own throwing?"[2] How the shadows come to throw shadows, even empty shadows, is a nice question. Illusion seems as hard to explain from such premisses as necessary truth. Descartes, it will be remembered, traced error to the independent activity of will. But that being gone, even throwing empty shadows should be impossible. However, leaving this aside for

[1] *Methods*, p. 245. Cf. below, Lecture XVIII, pp. 212 f., 217 ff.

[2] *op. cit.*, p. 161. But Huxley gives a very different version of this conception of necessity in other places. Cf., *e.g.*, vol. vi, *Hume*, etc., p. 285.

the present,[1] let us note in the next place, that — though not necessary in the logical sense, still — this concomitance of mental conditions, as collateral products of the changes which take place in the organism, is regarded as actually inevitable. It is natural law. Granted that we are only entitled to say that dice actually do fall, when they are thrown from the box, not that they must fall; granted that we may only say that their after course *is* entirely and absolutely the result of the initial conditions, not that it must be; still this is enough. Though not a logical necessity, yet the mechanical character of brain processes and their rigorous mechanical connexion with the other phenomena of the universe, also fundamentally mechanical, is held to be a fact. Also it is held to be a fact that, to quote our authority, "the soul stands related to the body, as the bell of a clock to its works, and consciousness answers to the sound which the bell gives out when it is struck." Again, I say, this is enough. There is no logical necessity, certainly, about a material configuration and its motions. Be it on a great scale or on a small, we can readily imagine it as other than it is, or as not existing at all. It may be logically as contingent as you please; it may never have been decreed; in this sense there may be neither 'ought' nor 'shall' nor 'must' about it. Theistic notions of any kind, one need hardly say, are altogether alien to the naturalistic standpoint. But a conscious automaton I am actually — on the naturalistic assumption, at all events. For that philosophy, matter and energy are indestructible and ingenerable, and the laws of their working rigor-

[1] Cf. Lecture XVIII.

ous, exact, and unalterable. And this, beyond all cavil, is what is meant by natural or blind necessity, ἀνάγκη, as the Greeks called it. This physical necessitation, according to the doctrine of conscious automatism, applies without the possibility of abatement to all our thinking and all our acting. "We are," as Huxley says, "but parts of the great series of causes and effects which in an unbroken continuity composes that which is and has been and shall be — the sum of existence." [1]

Nevertheless we are told that we are free, "inasmuch as in many respects we can do as we like." But such words do not mean at all what they seem to mean. They refer not to purposes carried out by an efficient agent and arbiter; they simply indicate a special class of pleasures, the pleasures that sometimes accompany motor reflexes. This is all they mean in fact, and all they can mean, if conscious automatism be true. The frequent use of illustrations like one used long ago by Spinoza, shews clearly how little action such 'doing as we like' is supposed to involve. "Imagine, if you can," said Spinoza, "that a stone, while its motion continues, is conscious, and knows that, so far as it can, it endeavours to persist in its motion. This stone, since it is conscious only of its own endeavour and deeply interested therein, will believe that it is perfectly free, and continues in motion for no other reason than that it so wills. Now such is this freedom of man's will which every one boasts of possessing, and which consists only in this, that men are aware of their own desires and ignorant of the causes by which those desires are deter-

[1] Huxley, *Collected Essays*, vol. i, p. 244.

mined."[1] Spinoza, it may be observed in passing, is concerned with free will, while we are concerned with mental activity simply. Still the point of the illustration holds for both. The activity, we are to understand, is as illusory as the freedom. If the stone's motion were due to itself, we should call the stone active; because it does not move itself, we call it inert and inactive. So, if the mind can really determine the movements of the body, as it is assumed to do in voluntary acts, then such acts deserve the name, and the mind is truly regarded as active. But if voluntary acts are purely mechanical, if "volitions do not enter into the chain of causation of the action at all" they do not deserve the name of acts and the activity of mind is an illusion.

And now that we have seen clearly what a very one-sided business this conscious automatism is, now that we are satisfied of the complete dependence (according to this doctrine) of the epiphenomenal series on the physical or phenomenal series, of which it is in some mysterious way but the collateral product, let us turn for a moment to the primary series, and recall the deliverances of modern dynamics concerning the sort of activity allowed there. The word 'action' and other words, ordinarily connoting activity, occur often enough. Thus we have: 'Action and reaction are equal and opposite'; 'Unlike electricities attract, and like electricities repel, each other'; and so forth. But efficiency is everywhere strenuously disclaimed. The very notion of cause

[1] *Letters*, No. 62, quoted by Sir F. Pollock, *Spinoza, his Life and Philosophy*, 1880, p. 208.

is voted a fetish to be replaced by equations, neither side of which can with any propriety be called either cause or effect. And accordingly the distinction of past and future, otherwise so fraught with meaning, becomes insignificant; the future here lies just as open to the scientific calculator as the past; both are alike fixed and clear. The whole course of things is one effect, one process. An efficient cause, a *primum movens*, there must have been at the beginning; but, on the other hand, such beginning may be indefinitely far off. So we might say of a body moving uniformly in a straight line, that it must at one time or other have been set in motion from without, but no one can tell how long ago; at this present time, however, it is under the action of no force. Though its position in space be regarded as changing continuously, there is no new action, no fresh interference. And so from the standpoint of the mechanical theory we are told to regard the world. Since it was first set a-going, this too has been free from the action of external forces and has received no accession of energy. Inert as a whole, and inert in every part, there is nowhere either choice or striving. The physicist's use of the term energy, must not mislead us, and will not, if we bear in mind the strictly mechanical interpretation which he puts upon it. The actual energy of a given mass depends solely on its speed, and this the body has no power to alter. It can receive only such energy as another body imparts to it, and can only part with such energy as another body receives from it. The *nature* of such dynamical transferences is a mystery; the *law* of them is exact in all cases and

always devoid of ambiguity. Matter and law are supreme throughout; there is nowhere either spirit or spontaneity. Some of the older materialists, as Toland and Priestley, insisted on the essential activity of matter, being misled by Newton's metaphors of attraction and repulsion and by such notions as Boscovich's of centres of force. But the mechanical theorists *pur sang*, as we have seen, will have none of this. The world as a whole, looked at as they conceive it, seems comparable to nothing so much as an upturned hourglass. The glass could not start itself; this, at least, was an interference from without, but it was an interference before the process, not during it. Science, which is confined to describing the movements of the sand, can give no account of this catastrophe, and no meaning to it. But once the glass is turned, the downward dance of the last grain to move is just as inevitable as that of the first; and the several movements being fixed, any collateral consequences of them must be taken to be fixed too.

There is then activity nowhere. The automaton would belie its name if its spontaneity were not as illusory as that which Spinoza imagined the falling sand to dream of. How then do we come to be talking of activity at all? If there were such a thing on the physical side, then possibly we could understand the assertion that on the psychical side it was non-existent. Or if mind be really active, we can readily understand that matter, in contrast to it, should be found to be inert. When it was a question whether the sun or the earth was to be regarded as fixed, it was plain that one or other moved; but would it ever have been maintained that the motion

of one of them was illusory, if both had been still? Once grasp the notion that the material world is wholly devoid of activity, and that there is no real activity in that mental world which is but its shadowy accompaniment, and there can be no question of "*banishing* spontaneity," no call to explain *away* the illusion of being 'up and doing.' We cannot banish the non-existent, or expose a counterfeit of what, as genuine, is unknowable and inconceivable. Paradoxical though it may seem, yet even the illusion of activity and spontaneity is certain evidence that activity and spontaneity somehow really exist; and since by common consent they are not found in the physical world, they must be in the psychical.

And here let me go back for a moment to insist further upon an objection just now mentioned, the full scope of which will be still more apparent later. If the doctrine of conscious automatism were true, this illusion and error equally with logical necessitation would be inexplicable. The apposition of brain-state and concomitant mind-state is declared to be the closest possible: the one keeps pace and varies with the other, as shadows follow after, and change with, the moving figures that cast them. The clock cannot sound six when the bell only strikes once. If, as Huxley tells us, "our mental conditions are simply the symbols in consciousness of the changes that take place automatically in the organism," how can they belie these? Concrete particular must then correspond immediately to concrete particular. To the continuous series of *neuroses*, molecular changes in the automaton, will answer *pari passu*, a con-

tinuous series of *psychoses*, fleeting mental changes. As collateral products of the physical chain these miscalled symbols have no direct connexion, either causal or logical, with each other. Sensations or feelings, mere items that cannot symbolise anything or be either true or false, we might call them; but judgments they could never be. Relations of coexistence and of succession they will have; but the recognition and affirmation even of these will be a fact utterly beyond, and distinct from, them, not an item among the rest. Still more distinct — upon another plane — from their mere existence as collateral products, must be any significance they may carry of existence and relations beyond their own. The consciousness in which they are symbols is not comparable with the ground on which shadows fall. Objects may project shadows, but shadows do not project objects, or set aside the order in which they occur for an order that explains their occurrence.

Great as is the disparity between sensations and molecular motions, it is as nothing to the disparity between molecular motions and thought. Thus Descartes, to whom, as we have seen, the entire doctrine of conscious automatism is due, habitually used the same term "idea," to denote the cerebral excitation, as well as the sensation proper. The same ambiguity is found lurking again in Locke's "new way of ideas," as Stillingfleet called it; and was the immediate occasion of Reid's vigorous polemic, now too much forgotten. For the sensory idea is still very much a *tertium quid*, neither purely mental nor purely material — as even Huxley's phrase 'collateral product,' incidentally shows. But for

Descartes, at all events, these sensory ideas were not necessary to mental life, which he regarded as essentially active and independent of matter. Even for Locke, the intellectual elaboration of ideas depended on the mind's own initiative and effort, in which matter as such had no part or share. In short, the dualism for these thinkers was not between sensations, as ideas proper, and cerebral impressions or material ideas; but between mind, as active in thought and volition, and matter as merely extended and inert. In other words, the dualism was between matter and spirit; man being regarded as an inexplicable blending of both. I have no concern now to dwell upon the inconsistency of the philosophy of Descartes in this point, — where again, by the way, he was followed in the main by Locke. Having emphasised the substantial dualism and essential disparity of mind and matter, a philosopher who boasted that he had admitted nothing as true but what was clear and distinct, ought not to have been content to say that in human nature both were merged, as it were, into one substance constituting literally a conscious automaton. What it interests us to note, however, is merely this: Simply and solely because of his intellectual and voluntary activity was man, for Descartes, a *conscious* automaton, and for lack of such activity the brute a *mere* automaton. In such intellectual and spontaneous activity lay the essential and necessary characteristics of spirit. Sensations and other 'passive states' were for Descartes as inexplicable from the side of mind as they were from the side of matter. They were not the mind's handiwork; and they existed solely for the benefit of the

composite whole of mind and body, to indicate what things are beneficial or hurtful to that. They were not to be regarded as elements of knowledge; for this by their irreparable confusion and obscurity they were altogether unfitted. Thus widely then did the conception of man as a conscious automaton, which Descartes entertained, differ from that which Huxley imagined him to hold, and held himself.

The question then arises: Can this spirit and spontaneity that for Descartes and Locke were the inalienable property of mind, can these be banished from the psychical world, as assuredly they must be if the modern doctrine of automatism is to stand? What are the facts? It is all very well for the upholders of automatism to say there is no room for them, but what if they are there? *Prima facie* their reality is unquestionable, and the world at large would doubt the sanity of one who should go about with great pains and labour to prove it. But what then are we to say of our modern naturalists who claim to disprove it? Every man knows the difference between feeling and doing, between idle reverie and intense thought, between impotent and aimless drifting and unswerving tenacity of purpose, being the slave of every passion or the master of himself. And what he finds in his own experience — this fundamental contrast of passivity and activity — he believes to be shared by all his fellow-men, nay, though in less developed forms, by every living thing. Experience in every case consists in interaction between individual and environment, an alternation of sensitive impression and motor expression, the one relatively passive, the other

relatively active. Absolute activity and absolute passivity are limiting conceptions to which we have no answering experience, the one being commonly attributed to God only, and the other only to primeval matter. Devoid alike of creative efficiency and of the inert indifference of senseless clay, each man finds himself, and believes all other sentients to be, at once sensitive and reactive, feeling as well as receiving, and prompted by feeling to act. It must surely ever remain futile, nay, even foolish, to attempt to explain either receptivity or activity; for what is there in experience more fundamental?[1] And being thus fundamental, the prime staple of all experience, it is absurd to seek to prove them real, since in the first and foremost sense of reality the real and they are one. What then, I ask again, are we to say of the attempt to disprove this reality?

It is useless for our opponents to reply that they have no intention of denying the reality of consciousness, that on the contrary they admit an answering psychosis to every neurosis. But they insist that the psychoses shall be always and wholly determined by the neuroses, and the neuroses in no sense and never determined by the psychoses. They claim, supported by a shallow and perverted psychology, to treat all psychoses as affective or sensational, calling volitions feelings, and regarding them equally with sensation as but the shadows or symbols of molecular processes in the brain. I do not propose to remark further on the inadequacy of this account even of the sensational and cognitive phase of consciousness. But if our acts are only feelings, only symbols of changes

[1] Cf. below, Lecture XIV and Lecture XIX.

which they in no wise produce, changes predetermined in the very structure of the physical world as a mechanism, then they are unreal, they are not what they seem to be. If consciousness is powerless to affect the neural process, *a fortiori* it is without effect on the external changes that are consequent upon these. And this is a statement from which the upholders of the automaton theory do not shrink. When we say that man has subjugated nature and changed the face of the earth, this is only to mean that the building of cities, that all the manifold triumphs of art and civilization, are but part and parcel of the one vast mechanical process, to which the upheaval of volcanoes and the formation of crystals in their cooling crust also belong. The consciousness of aims, acts, efforts, that accompanied those miscalled artificial processes, was not the source of their supposed teleological characteristics. The physical series all through has been self-sufficient, free from all extra-physical direction, alike where a psychical series has been its collateral product, and where it has not. Everything teleological and directive is either absent or recedes asymptotically into the indefinite past. And yet we are not to conclude that the consciousness of activity is illusory; because the psychical series of 'feelings,' we are to understand, like the physical series, goes along of itself. Not to insist further on the fact that this strict parallelism is never upheld, that the psychical series only goes along of itself in the sense of not *reacting* upon the physical series on which it is held to be functionally dependent, let us ask: What according to this view is the psychical series?

In 1868 Professor Huxley wrote these words: "We

live in a world which is full of misery and ignorance, and the plain duty of each and all of us is to try to make the little corner he can influence somewhat less miserable and somewhat less ignorant than it was before he entered it. To do this effectually it is necessary to be fully possessed of only two beliefs: the first, that the order of Nature is ascertainable by our faculties to an extent which is practically unlimited; the second, that our volition counts for something as a condition of the course of events."[1] With this, I take it, most of us agree; but what are we to say of the following emendation of this second belief substituted by Professor Huxley as a foot-note in 1892? Our volition, "or to speak more accurately," he then added, "the physical state of which our volition is the expression."[2] Not, be it remarked, the physical state which is the expression of our volition, whereby that might 'count for something' in the course of events. Not this, but the physical state of which our volition is itself the expression is the new gloss! Is it possible to make these two statements mean the same thing? For my part I say it is not possible. Is it possible to prove the earlier statement illusory? Again I say it is not possible. Illusory experience obviously implies, as I have already urged, a counterpart experience by which its falsity is made manifest; absolute illusion, like absolute motion or rest, cannot be experienced. The contrast between receptivity and activity is essential to the experience of either of them, that is to experience at all. A paralytic is the subject of illusion when, having willed to make a movement, he is

[1] *Collected Essays*, vol. i, p. 163. [2] *l.c.*, note.

unaware that no movement has resulted; but such illusion is possible, only because he has previously found his volition effective. The spectators of an epileptic under seizure may be under the illusion that the man is acting violently, but again only because they have previously seen like violent action in persons who were responsible. The conscious automaton theory combines and generalises these two cases of illusion, so as to exclude the very experiences which makes the illusoriness apparent. On the psychical side, according to them, all our volitions are like those of the paralytic; on the physical side all our overt movements are like those of the epileptic. A conscious automaton is thus like a paralytic and an epileptic rolled into one, the impotent volitions of the first keeping step with the motor discharges of the second. To complete the figure we must, as I have lately remarked, extend it to intellectual activity too, and resolve thinking into an orderly raving or reverie that accompanies the physiological process of 'cerebration.'

But let us go back to the question: What exactly is the psychical series? for the sake of which I was led to quote Huxley's comment on himself. According to his unamended creed, we find volitions conditioning the course of external events; whereas according to his address on Animal Automatism, a volition is a 'feeling' merely: it is not the cause of a so-called 'voluntary act' but "a symbol of a state of the brain." But how then, we ask, can it 'count for something as a condition of the course of events'? If the psychical series cannot intrude into the physical, then the course of events, into which volition enters as a determinant, must

itself be part of the psychical series. Huxley, presumably, decides for this alternative, for on proceeding with his exposition of agnosticism he tells us that "in itself it is of little moment whether we express the phenomena of matter in terms of spirit, or the phenomena of spirit in terms of matter."[1] But what in the present case are we to make of this result? It is plain that we shall now have got two psychical series; one to which the individual's volition directly belongs, and another consisting of the general course of events, to which it does not directly belong. When, then, we describe this general course of events from the spiritual standpoint, the individual's volition counts for something, as conditioning that course, and each man's environment, his 'little corner,' is affected by what he thinks and says and does. When, on the other hand, we describe this same course of events from the material standpoint, there is no place for such activity and efficiency. But surely these two 'highest truths,' as Huxley apparently means to call them, are as hopelessly at variance as were the Aristotelian and Christian dogmas which the scholastics were wont to maintain side by side. Had Huxley too, we wonder, a doctrine in reserve like theirs of a 'twofold truth'? Did he too mean to advocate a sort of 'book-keeping by double entry,' one in spiritualistic terminology, and one in materialistic? Anyhow the notion of a conscious automaton, which is said to result from combining the two, proves to be a palpable contradiction. If we cannot give the lie to our direct experience, whence all our conceptions of activity and the realisation of ends

[1] *o.c.*, p. 164.

are derived, and if also we cannot deny the unbroken concatenation of all things, whether organic or inorganic, in accordance with strictly mechanical laws, we are face to face with a most serious antinomy — the old antinomy of the teleological and the mechanical, in a word.

Coming upon this antinomy in this wise, the first step towards a solution that suggests itself is to determine which is epistemologically the more fundamental standpoint, that in which the spiritualistic terminology is employed, or that in which we employ the materialistic. We cannot be content to leave them on a par, confronting each other but in irreconcilable antagonism. This would only aggravate the antinomy. The conscious automaton theory, as we have seen, does not leave them on a par, but decides to stand ultimately by the latter. "The materialistic terminology," Huxley has told us, "is in every way to be preferred. For it connects thought with the other phenomena of the universe, . . . whereas the alternative, or spiritualistic terminology, is utterly barren, and leads to nothing but obscurity and confusion of ideas." No wonder then that naturalism, seeming to find clearness and distinctness on the one side, and on the other obscurity and confusion, ventures to discredit the plain testimony of experience and to declare our power over nature illusory, in spite of the utter absurdities to which such a declaration leads and the inconsistencies it entails upon the naturalistic philosophy itself. We are thus brought again to the second of the two positions that we had reserved for special examination, the assumed primacy of the physical series, on which the position that we have just examined, the denial of psychical activity

and initiative, is based. But I do not propose to enter upon the discussion of that second position at once. It leads so directly to the subject of agnosticism that I will ask you to consider first another question which will afford us a convenient opportunity of gathering up some of the results of this long examination of naturalism.

So far it has been assumed that the mechanical theory shuts us up to a rigorous determinism incompatible with teleology. This is unquestionably the prevalent view, but is there no escape from it? Is there no way in which mind can influence matter without interfering as it were 'miraculously' with mechanical laws and so far subverting the supposed foundations of natural science? Personally I believe there is no way. If the Laplacean conception which we have taken as the text of this whole discussion is to hold in its entirety, it is even more certain that there is in the physical world no room for man, than it is that, as Laplace boasted, there is no need for God. We must say—and the naturalists we have seen have had the courage to say it: The physical world is a complete whole in itself, and goes along altogether by itself. We must say: The very same laws fundamentally, that determine the varying motion of the solar system, bring together from the four corners of the earth the molecules that from time to time join in the dance we know as the brain of a Dante creating immortal verse, or as the brain of a Borgia teeming with unheard-of crimes. And finally we must say: The presence of mental epiphenomena is as irrelevant and immaterial to the one result as is their absence to the other.

Nevertheless attempts have frequently been made — and are continually being renewed — to find in the mechanical theory itself some loophole of escape from these absurdities. The first of these was broached by Descartes himself in the famous doctrine that the soul from its punctual seat in the pineal gland directed the movements of the animal spirits as it willed. The quantity of motion, the product of mass × velocity, Descartes maintained was constant, but its direction he imagined was more or less indeterminate. This was afterwards shewn to be a mistake. Descartes, in fact, like Mr. Herbert Spencer after him, was ignorant of the full meaning of the principle known as the *Conservation of Momentum*. According to this principle, however, the direction of a motion is as completely determined by mechanical conditions as its speed is. The one, as little as the other, can be altered without an external force; and in mechanics, external force implies a second mass having an equal and opposite mass-acceleration to that of the mass said to be moved. Had Descartes but realized this, urged Leibniz, he must have seen the mechanical impossibility of the soul directing the flow of animal spirits in the way he supposed; he must have come round to the doctrine of the preëstablished harmony as the only solution.[1] The much simpler plan of denying the unconditional supremacy of the laws of motion was hidden from Leibniz, though seen by Kant. But more of this hereafter.

Other attempts set out from cases in which the determination of a movement, or of the course it shall

[1] Cf. Leibniz, *Théodicée*, §§ 60, 61.

take, are said to be theoretically possible without the expenditure of energy. Take a body at rest in a position of completely unstable equilibrium: you may suppose it as large as you like, yet the work to be done in upsetting it may be less than any assignable amount, have, that is to say, no limit but zero. Perhaps the most impressive instance of this kind is that of the blasting of 'Hell Gate' at the entrance to Long Island Sound, when, a little girl laying a finger on an electric button, some million tons of earth and water were shot upwards with a deafening roar. The brain change that determined that finger movement was a case of disturbed equilibrium perhaps more wonderful still, infinitesimal compared with the resulting eruption — and that might have been indefinitely greater than it was. Yet there is no ground for saying that even the inexpressibly delicate brain discharge was due to an initial disturbance involving no transference of energy. To suppose that matter in however unstable a condition can be set in motion without receiving any energy from without is not to find a loophole within the mechanical theory, but to deny the absolute validity of its most fundamental conception — that of inertia. If such an assumption is legitimate, the first law of motion is not true. Whether it is true or not is another matter; but as the attempts in question take this law for granted, they are obviously fallacious, confounding, in fact, an indefinitely small quantity with no quantity at all.

The other case mentioned is somewhat different. I can best describe it by a brief quotation from Maxwell: "The dynamical theory of a conservative material

system shews us that *in general* the present configuration and motion determine the whole course of the system, exceptions to this rule occurring only at the instants when the system passes through certain isolated and singular phases, at which a strictly infinitesimal force may determine the course of the system to any one of a finite number of equally possible paths, as the pointsman at a railway junction directs the train to one set of rails or another."[1] It is assumed that such mechanically indeterminate phases predominate throughout the organic world, and that to life or mind belongs the power of determining along which of two or more mechanically indifferent paths the elements of an organised system shall go. Brain-cells in particular are supposed to be systems of this kind. The question is not now, whether such guidance exists, but whether there is any reality, corresponding to dynamical equations with singular solutions, to which on this assumption such guidance is confined. The question, in other words, is whether the mechanical theory leaves any such loophole for extra-physical intervention. The answer, it seems, must be *No.* For that theory does not admit material systems in isolation, but insists on treating the whole material universe as one; it is only in thought that we can abstract one part from the rest. Even granting that then data may be wanting to furnish an unambiguous forecast, all such indetermination, it is held, would disappear as soon as other systems, or the rest of the universe, were taken into account.

[1] *Revelations of Paradoxical Philosophy*, *Nature*, vol. xix, p. 141. *Collected Papers*, vol. ii, p. 750.

Many other endeavours, more or less subtle and ingenious, have been made to find a place for voluntary and purposive action *within* the mechanical scheme, taken thus in its entirety. Mathematicians are the proper judges of the validity of such attempts, and apparently they reject them all. If only matter in motion can set matter in motion it is plain that mind, which *ex hypothesi* is not matter in motion, cannot do it. If, taking the universe into account, there are no unbalanced forces, then whenever a given mass undergoes a certain acceleration, *i.e.* is subject to an impressed force, another mass simultaneously undergoes an equal and opposite acceleration, *i.e.* is likewise subject to an impressed force. Calling the one the action, and the other the reaction, it then becomes absurd to suppose the reaction to be a mass-acceleration, and yet to contend that the action is a volition, unless such volition is but an impotent 'aspect' of the opposite mass-acceleration, which is the very supposition to be avoided. It would seem, therefore, that there is no middle course left to us. Either the universe is mechanical or it is teleological; it is not likely to be a mixture of the two.* But to justify naturalism, the mechanical theory must explain everything: what it does not explain must be unreal and illusory. Naturalism, we have seen, has for its base of operations the primacy of the physical series; and, setting out from this position, it undertakes "the gradual banishment from all regions of human thought of what we call spirit and spontaneity." If it cannot succeed altogether, it must fail altogether. In the next lecture I propose to gather up the results of our inquiry on this point

* See Note iii, p. 606.

and to offer some final reflections which they suggest. We shall then be prepared in later lectures to contest the assumption that for knowledge the primacy of the psychical standpoint is, as Huxley has declared it, "utterly barren and leading to nothing but obscurity and confusion of ideas." It will then be not so much with naturalism as with agnosticism that we shall have to reckon.

LECTURE XIII

SUMMARY AND REFLEXIONS

Abstract Dynamics does not furnish us with a Natural Philosophy, but with a descriptive instrument of uncertain range. Facts cannot be maimed to fit it, but it must be modified to suit them.

Even what can be mechanically described *need not be, and experience may convince us that it is not, mechanically* produced.

It is impossible to divest living beings of "internal determinations and grounds of determination." Descartes' distinction of causa formalis *and* causa eminens. *Physics recognises only the former, and resolves that into an equation. The latter, being excluded from its premisses, is supposed to be excluded from existence. On this fallacy the doctrine of conscious automatism is built up. Inertia not a fact but an ideal.*

Conservation of energy essentially a law of exchanges. That the whole energy of the universe is constant in amount and 'phenomenal' in character, not proven.

The theoretical physicist having eliminated causation, must not dogmatise about it. The crux *of irreversibility suggests that the world is not a mere mechanism. The physicist only describes the* utterances *of real things and the after-course of these utterances, so far as left alone. He is obliged to admit interference, but prefers a maximum breach of continuity far off rather than orderly direction now.*

Such direction impossible if all the beings in the objective universe are inert. No warrant for preferring dead things rather than living as the type of such beings; and if we want to understand the world and not merely to calculate it, we must start from some other type.

The mathematical bias the source of naturalism. It can only be corrected by observing how it has arisen. Mechanism by itself is chaotic and meaningless. With mind first come law and order. And mind we have seen implied as a vis directrix, *at least, in evolution, in natural selection, in psychophysics.*

We have accepted the decision of the upholders of the mechanical theory of the world that in that theory no place is left for consciousness to intervene as a determinant of material changes. We have seen—as a moment's reflexion suffices to show—that such a supposition is incompatible with the strict premises on which that theory rests. If the material world is in itself a complete whole; if all its changes are but transferences of a common stock of energy constant in amount from one to another of a common stock of vehicles or receptacles, also constant; if such transferences are determined by nothing but relations of time and space and number; and if time and space are continuous and uniform throughout,—there is no room for ambiguity, no opportunity for meddling, and no possibility of control. But we have not accepted those premises, and are therefore free to urge this result as an argument against naturalism, which *has* accepted them.

The mechanical theory of the world we have traced to a natural prejudice supposed to be the special infirmity of metaphysicians—that of ascribing objective existence to abstractions. Now, if ever there were abstractions, the time and space and mass of abstract dynamics are such. In the earlier lectures I endeavoured to follow the progress of the mechanical theory, as one after another of the qualitative diversities we perceive, were brought within the range of quantitative description, till what at the outset was avowedly but an aspect of sensible bodies became at last the entire reality of their ultimate constituents. How much more is this earth than a mass-point with a certain numerical value, moving in

accordance with dynamical equations among the other mass-points of the solar system? Yet there are people who imagine that when they have resolved the whole earth and all that happens on it into motions of such mass-points, traceable by pure mathematical analysis, they have attained to a philosophy of nature. The much decried thing *per se* thus turns up where we should least have expected to find it: 'what actually goes on behind what we see and feel' is, we are to believe, simply the motions of one ultimate fluid characterised throughout by negative attributes. Others, whose faith is not equal to this resolution of the phenomenal world into "non-matter in motion," have seen what we take to be the truth, — viz., that mechanism is not the one reality behind the veil of phenomena: that is to say, they too repudiate the mechanical theory, as we have done. Abstract dynamics is for them not a natural philosophy, but a hypothetical descriptive scheme, originally devised and continually amended so as to summarise, in the simplest and most comprehensive form, the movements that occur in nature. If there are facts that do not conform to it, or only conform approximately, so much the worse for it; it must go or be modified; the facts will stand. If, again, there are facts beyond its purview, that is not a reason for chopping experience in two, but a plain proof that experience transcends its range, and that the world is not fundamentally mechanical. To suppose that the rigorous determinism deducible from the abstract scheme — for the simple reason that it has been put into its fundamental premises — *must* apply also to the real world it

has been devised to describe, is just as absurd as — to take a very trivial illustration — it would be to say that a man must fit his coat, and not that the coat must fit the man.* There may be nothing in the world answering to the conception of inert mass; it may be as pure a limiting non-entity as the *prima materia* of philosophical speculation. And as to the conservation of the energy analytically distinguished from it, this again is but a regulative principle, an idea, not a fact. It is impossible to deprive a body of all its energy and so measure its amount; impossible, again, to say what latent forms of energy there may be, to which our senses furnish no clue, direct or indirect. On both these points, the assumed reality of mechanical determinism and the true character of the principle of energy-conservation, it will be well to enlarge a little. To begin with the first:—

The physical investigator is never in the happy position of the mathematical theorist, face to face with the ultimate elements of mass in pure space and time, and like a demiurge completely master of all his data, able to assign to each element its share of energy and its position. The mathematical theorist employs direct methods, as when, to take a simple case, two incident forces being given, he ascertains their resultant. But the physicist is largely shut up to inverse methods which leave room for numerous solutions, as when, a force being given, its possible components have to be ascertained. Hence in his endeavours to describe physical phenomena in purely mechanical terms, he is driven to imagine various mechanical devices to simulate them, and has to trust that

* See Note iv, p. 607.

crucial phenomena will gradually eliminate such of these devices as are halt and lame. And when we reflect that in mass, space, and time, the physical speculator has at his disposal a sixfold continuum, we begin to realise that there need be no end to hypothetical mechanisms.* Leibniz, for example, did not hesitate to affirm that in a living body every smallest part is a machine, though such body be divided *ad infinitum*.[1] Our modern physicists, however, require all this apparatus to describe even bodies that are not living. But let us imagine, as Leibniz did, that we could magnify an organic cell or nucleus till we could examine it in detail, as we might a factory full of machines; and let us suppose somewhere within that a body that really did move spontaneously and change its direction free from any impressed force. What would the theoretical physicist say to this? Without a moment's hesitation he would quote his laws of motion and postulate a second body (or mass-system) with an equal and opposite acceleration; though no evidence — or, as he would say, no other evidence — of such a body, were forthcoming. Just so the Pythagoreans with their preconception of numerical fitness postulated an ἀντίχθων or Invisible Earth to complete the decade of heavenly spheres, thereby, as Aristotle said, "forcing phenomena into accordance with certain reasonings and notions of their own."[2] This comparison, though it may seem outrageous, is just in the one respect that the law of inertia, when its scope is made coextensive with that

[1] *Monadologie*, § 64.

[2] Cf. note by W. H. Thompson in his edition of Archer Butler's *Lectures on Ancient Philosophy*, vol. i, p. 341.

* See Note v, p. 607.

of the entire world, animate and inanimate, is assuredly a preconceived postulate and not an ascertained fact. What *is* ascertained fact is merely that mass-aggregates, such as planets, billiard-balls, and other mechanical paradigms, conform to this law as far as they can be observed. That the living bodies of St. Paul, Christopher Columbus or John Howard conformed to it is assuredly not an ascertained fact. Let us, however, return to our physical theorist in the magnified protoplasmic cell, and let us assume that the movements of the spontaneous being we have supposed him to find there manifest all the diversity and lack of routine that commonly characterise living things; further, that these movements concur with certain states of the machines among which the being moves, while these in turn seem affected by its presence. What now would the physicist say? Certainly not, if he abides by his principles: "Here is a controlling and initiating mind"; nor even: "Here is a conscious automaton." Rather he would say: "Self-determined motion is for me a sheer impossibility. This complexity of motion points to an equally complex mechanism. Action at a distance, again, my principles do not allow. Obviously, therefore, there is some ethereal medium here; so much the relations of this being's movements to those of the machines compel me to believe. Let us imagine that erratic being magnified in its turn as the cell was before, and we may hope to invent some concealed machinery which might account for its unpredictable behaviour."

With such powers of indefinite magnification and indefinite multiplication of hypothetical mechanism, it is

possible, I say, that the most complex vital phenomena the physiologist can ever discover could be mechanically described. But it would not follow, even then, that they and all beside them really were mechanical.[1] To establish that, every infinitesimal mass concerned must be ascertained and ear-marked, the path of each one must be traced, and there must be no hidden machinery, no resort to statistical averages, no ignoration of coördinates, or the like. If the physicist, starting thus from the very beginning, could directly shew that the result accorded with his descriptive scheme, the verification would be then complete; the hypothesis would have become fact and the abstractness be at an end. Thereafter the idea of psychical guidance would not merely conflict with a theory: it would be refuted by facts. Meanwhile, however, there has been no such direct refutation; and, further, it is obvious that there never can be. But, on the other hand, there is still no prospect of direct physical evidence to shew where psychical interference actually does occur, and where in consequence the molecular movements in a living body cease to be entirely determined by mechanical relations. The question on this plane is an open one, albeit the difficulties besetting the mechanical theory even of organic processes seem steadily increasing.

At this point Kant's declaration, that "hylozoism would be the death of all natural philosophy," recurs to us. "On the law of inertia and its conservation," we have found him saying, "rests entirely all possibility of a proper science of nature,"—with which name he dignifies this

[1] Hertz, *Gesam. Werke*, iii, 321, p. 166 ; Larmor, *Æther and Matter*, p. 288.

abstract descriptive scheme, assumed by him to be *a priori*. Again I say we must allow that this is so, and again I would ask: And what then? Are we to conclude that all experience would lapse into unintelligible confusion unless living bodies were "absolutely devoid of internal determinations and grounds of determination?"[1] But our own activity — which Naturalism cannot seriously gainsay — is only possible, and the chiefest part of our experience is only intelligible, on the supposition that living bodies are not thus devoid of self-determination. This, I would insist, is not a fact to prove or to explain, but one to disprove and explain away for those who can. What then if we *deny* that a living man or even a living mouse is merely, like the solar system for the astronomer, a material aggregate devoid of internal determination? Two or three things follow. For one, there is an end of the mechanical theory as conceived by Laplace. "If we seek the cause of any change of matter whatever in life, we shall have," says Kant, "to seek it at once in another substance, distinct from matter, although bound up with it." Laplace's famed intelligence then will have, as I have already said,[2] to add to his world-formula, at the moment he obtains it, a complete foreknowledge of all those changes of matter which mind will induce, assuming, as we reasonably may, that the formula itself will take account of all changes so produced up to that moment. Still, when we remember that even the chemical atom, which might have some claim to rank as one of

[1] Cf. Kant, *Metaphysische Anfangsgründe der Naturwissenschaft*, Hartenstein's edition, Sämmtliche Werke, vol. iv, p. 439.

[2] Cf. Lecture VI, p. 176.

Laplace's "real beings" has to be resolved into a complex of prime atoms and these into mass-points before the mechanical theory can have full sway, nay, that even the ether must submit to analysis, it is obvious that the feats of the Laplacean intelligence cease altogether to be conceivable. In short, we may take it as definitely conceded by the physicists themselves that descriptive hypothesis takes the place of a theory concerning "real beings."

Another consequence of admitting that mind can control matter, will be that somewhere within the living organism physical events will happen that have other than physical conditions. Whether "natural science proper" will ever penetrate far enough into this *arcanum arcanorum* to find itself face to face with such a 'miracle' remains to be seen. But up to those uncertain limits it will still have a vast range and unfettered scope. And besides, if it renounces its old pretensions of being a natural philosophy, abjures the categories of substance and cause, and only claims to describe events, it might still be possible to express abstractly in mechanical terms effects that in fact were not mechanical. Such a procedure I endeavoured just now to picture. There is an old scholastic distinction much used by Descartes that may serve to put this in a clearer light. When a cause was related to its effect as a seal, say, to its impress, it was a *causa formalis;* when, as the engraver to the seal, it was a *causa eminens*. Thus if one body is set in motion by another the motion is produced *formaliter* in the Cartesian sense; but if a body were set in motion by mind such motion would be produced *eminenter*. To suppose that every motion is mechanically produced would then be much on

a par with supposing that all pictures are printed, and none drawn; seals always moulded, and never engraved by hand. The principle — *a priori* fallacy, as Mill with some reason calls it — that like can only be produced by like, so excluding eminent causes, lies, as we have seen, at the base of the whole doctrine of psychophysical parallelism. It is then but an easy step to the exclusion of cause altogether; especially so, when the processes concerned consist simply in the transference of motion from one mass to another. This step, as we have seen, abstract dynamics has at length taken. A force is no longer a cause — "whatever produces or tends to produce a change in a body's state of rest or motion"; it is merely the effect or event, dynamically described, as mass-acceleration. When, then, it is said that motion that is not transferred motion is mechanically inconceivable, this is but an analytical statement pure and simple. It amounts to saying that it is inconceivable that what is inert should yet be active, or, more generally, that you cannot get the combination *a b d* out of the elements *a*, *b*, and *c*. On the strength of such truisms to deny that there is anything active, to deny the existence of other elements than *a*, *b*, and *c*, to deny that matter is ever moved save by matter in motion, is palpably a most unwarranted assumption, the only statement logically permissible being that the descriptive apparatus called abstract mechanics cannot recognise such motion. Yet on such an assumption the whole doctrine of psychophysical parallelism is mainly built up; reject that, and there is no serious argument left.

But, coming now to the second point — the precise

import and range of the principle of the conservation of energy. If mind *can* initiate or control the movements of matter, in other words, if a living body is not inert (whether because 'another substance, distinct from matter,' is bound up with it, or for any other reason), shall we not have to set this principle of energy aside?

This seems a formidable problem. But, in the first place, let us recall a distinction already made. It is one thing to ascertain the mechanical equivalents of various forms of energy and to assert the absolute constancy of these equivalents as part of the general postulate that nature is uniform. It is another thing altogether to assume that the quantity of energy in the universe is finite; and that, being finite, it neither increases nor decreases according to some law, or for some sufficient reason. The attitude of physicists towards this question is very much the attitude of an imaginary economist, who, knowing nothing of the production or consumption of wealth, should suppose that there were no economic laws but those of exchange. But now, even in a science so imperfectly mathematical as economics, it is still possible to work out demand and supply curves, in spite of the fact that the laws of production and consumption more or less complicate them. In the grander economics of nature the relations might be similar. What the physicist calls its working capacity or energy may or may not be constant; he cannot tell, for him it is an indefinite amount. He only knows that its rates of exchange or transformation are regular within the very narrow limits of his observation; and even within these limits, he is strictly confined to the average results of innumerable

individual transactions. If in spite of this ignorance physicists assume that the total energy of the universe is constant, much as a Cheapside crossing-sweeper assumes the population of London to be, their only justification is the simplicity of the assumption and its sufficiency for their purpose. But it is no more a necessity of thought than the assumption of the crossing-sweeper. And how often in the history of science have false and hasty assumptions been called axioms, only because they were simple and could not be proved?

Of course if we take 'the high priori road' of Mr. Spencer and Professor Tait, and affirm that the creation or destruction of energy is as inconceivable as the creation or destruction of substance, we are so far safe. On the inconsistency and futility of this recourse to metaphysics and the noumenal I have already dwelt. It is not with Mr. Spencer's Unknowable Force, that persists but cannot be measured, that we have to do, but with its knowable manifestations that do not persist but are transformed continually. All we have then—besides the axiom that from nothing nothing comes—are the experimental determinations of the quantitative equivalents of certain of those transformable manifestations. From such data it is plainly impossible to prove that this *phenomenal* energy in the universe is fixed in amount. And the physicists themselves are beginning to see this more and more clearly, and frankly to admit it. Those who insist that the quantity of this energy in the universe *must* be constant seem to me in the same position as one who should maintain that the quantity of water in a vast lake must be constant

merely because the surface was always level, though he could never reach its shores nor fathom its depth. We must remember too that this assumed constancy is only kept on its legs at all by counting in, first, the so-called *potential* energy, which is not actually energy at all nor mechanically of the same dimensions,—capacity for work and capacity for capacity for work not being on a par; by counting in, secondly, *dissipated* energy, which is capacity for work forever devoid of opportunity; and by allowing, finally, that in every material system there is an indeterminate amount of *latent* energy, of which nothing is known.

But whether the whole energy in the world be constant or not, still if mind is to initiate material movements, must it not itself be a form of energy and have its equivalent transformations into other forms like the rest? An objection of this kind[1] may be expected at this point, and it will appear unanswerable to those who accept the mechanical scheme as a complete and rounded whole. But this is just the conception we are primarily concerned to combat. Is there nothing beyond this everlasting transference of motion from one moving mass to another?

When I was a child my mind was much exercised, because I could never find the beginning of a piece of string; all the string I could get hold of had had the beginning cut off. I was in a fair way to conclude that string had no beginning, but that every piece was cut off another piece, in turn cut off another, and so on forever. But one day, passing a rope-walk, there to my

[1] Cf. above, Lecture XI, p. 23.

delight I saw string emerging from a bundle of tow that was not string at all. Now Naturalism seems to have taken up a position analogous to that into which I was lapsing, and unfortunately there is no such easy way of escape. Naturalism reduces phenomena ultimately to motions determined by other motions, and so without end. It sees in the world but a variegated tapestry of illimitable extent, the warp and woof of which are motions. Keeping to the facts discernible from its standpoint, it fails either by observation or experiment to discover new threads entering the fabric; then, turning to ideas, it devises a descriptive scheme, according to which such entry is inconceivable. Yet its 'day of Damascus,' to use a phrase of Du Bois-Reymond, might any time have dawned upon it, as it did half dawn upon him. The simple reflexion that the *facts* before it could never establish a negative; and again that ideas or theory must conform to facts, not facts to theory,— such reflexions, I say, would have sufficed to shew that the determination of motion otherwise than by antecedent motion is in itself neither impossible nor absurd. Then, with the scales of prejudice thus far cleared from its eyes, the one plain fact of voluntary activity might have been welcomed as a truth instead of being scouted as an illusion.

At all events these two things seem certain — that mind does somehow direct the movements of matter, and that the constancy of the phenomenal energy of the universe is neither a fact established by induction nor a necessity of thought. The effects of psychical determinations of the motions of inert matter, if matter

be indeed inert, would, presumably, persist as truly as the effects upon it of antecedent motions persist. Once within the fabric which the physicist seeks to describe, they would be indistinguishable from other effects. Nay, as we have seen, they never could be distinguishable so long as physical description is confined to the use of an abstract scheme, and cannot, even in the working of a crowbar — to recall Thompson and Tait's instance — come to close quarters with all the causes concerned; but must acknowledge even that apparently simple question to be in its completeness 'an infinitely transcendent problem.' If the exponents of modern dynamics were content to recognise causes and to describe force as Newton did, then mental direction would be a force. If, however, the conception of cause is to be eliminated, that description by equations may be possible, we have no right to object; nor indeed any ground to complain. Only the physicist who, in order to be mathematical, dispenses with causes must not dogmatise about them. But of course no one supposes that causes are absent from physical events: causes are only ignored. They are ignored, first, because mass-motions being alone considered, quantitative relations suffice; and again because, such motions being both reciprocal and reversible, we can not only say the cause equals the effect but it becomes indifferent which we call cause and which effect. But when qualitative processes or processes of development are in question this is no longer possible. The internal nature, both of agent and patient, has to be taken into account and the time-order is essential. But inert mass has no qualities; and the conservation of

energy, regarded as a mechanical principle,[1] is simply the maxim, *Causa æquat effectum*, applied where only mass-motions as quantities are concerned and where the masses are assumed to be indestructible. This is substantially the result to which the expositions of Meyer and Joule reduce it, as in the earlier lectures we have already seen. In this form, however, it is but a logical principle. It affords no basis for assertions about the total capacity for work in the universe, nor for assertions about its possible sources.

Such source or sources there must surely be; and if we are to call them too 'energy' the word must carry a different signification from that which the physicist gives to $mv^2/2$. As there are no known processes by which dissipated energy can be returned to its source as available energy, may it not be that available energy is derived from a latent source to which it cannot be physically returned? The reversibility, in short, which a purely mechanical scheme presupposes and which yet the actual world does not permit, at once suggests to the open-minded that there is more in heaven and earth than is dreamt of by the naturalistic philosophy. But, of course, in whatever way we suppose changes of motion not determined by precedent motion, such supposition, it will be said, is tantamount to regarding the world as not simply a mechanism. Certainly, I admit this, and urge that the absence of reversibility equally implies it. The solar system would work just as well,

[1] The upholders of the new science of Energetics contend, of course, for a wider interpretation. But they have still to make their way. Cf. Lecture VI.

revolving from east to west, as it does revolving from west to east. Reverse the spring, and a watch would go just as well backwards. So generally in *theory;* as much indeed is implied in treating causes and effects as mere sides of an equation, in which all the signs can be changed. Time-order does not enter. So in theory, I say, but never so in *fact*. How to get rid of this discrepancy is still, I understand, an anxious problem for the mathematical physicist. Meanwhile are we not justified in suspecting that there is something more in physical causation than can find its way into dynamical equations? The absurdity of a reversal of organic processes is evident, the tree shrinking back into the seed, life beginning in a corpse and ending with a birth, everything genealogical running backward, natural selection and survival of the fittest not excepted. And what of the psychical series as a collateral product of the physical in such a case? This question brings us to the point. Facing the future we are efficient, facing the past we are helpless. What is done cannot be undone; over what is still to do we can give or withhold our *fiat*. Capacity for work — a mere *δύναμις* — then passes into veritable *ἐνέργεια*. But what is done makes a new doing possible, so

> That men may rise on stepping-stones
> Of their dead selves to higher things.

Looking at the world in this wise, may it not be that the physicist deals only with the *utterances* of what we may call the *insides* of things; and dealing with them only and taking them for all, is thus led to deny inside existence

altogether? We have seen abundantly how abstract his whole procedure is, how reality slips through his fingers as he resolves atoms into ethereal vortices, and ether into an universal plenum as devoid of internal difference as empty space itself. And then, having got thus far, and all question of an 'inside' being utterly banished, he is forced at length — in open violation of his guiding principle, continuity — to look to something extra-physical or metaphysical to endow his medium with motion. Is it less scientific to regard such interferences as continuous and orderly? Mind must agitate and direct the mass, it seems; why then, unless to simplify mechanical description, has the physicist, to quote Professor Tait, "driven the operation of that mystery called life or will out of the objective universe?"[1] And having done so, by what logic does he contrive to call such life or will a 'collateral product'? Surely, if Naturalism did not despise all metaphysics but its own, it might have learnt from philosophy a better way. Kant's conception of man as at once phenomenon and noumenon is better than this. Perhaps Lotze puts the same idea more clearly, and in a way more germane to these remarks, in a passage of his *Microcosmus*, which has often impressed me, concluding with the words: "The course of the world (*Weltlauf*) may every moment have innumerable beginnings whose origins lie outside it, but can have none not necessarily continued within it. Where such beginnings are to be found we cannot beforehand say with certainty; but if experience convinces us that every event of external Nature is at the

[1] *Unseen Universe*, p. 183.

same time an effect having its cause in preceding facts, it still remains possible that the cycle of inner mental life does not consist throughout of a rigid mechanism working necessarily, but that along with unlimited freedom of will it also possesses a limited power of unconditional commencement."[1] It was in pursuance of the same thought that I just now suggested that possibly the physicist's so-called *actual* energy might spring from an efficiency of a higher order as well as sink to the level where, as *dissipated* energy, it is available for work no more.

But on the platform of our present argument — that of the primacy of matter and its laws — these are mere surmises. Suppose we assume then that mind only directs energy, and is not a source of it. Its action would thus be comparable to that of a force acting always at right angles to the direction of the moving body, thus altering its course without altering its speed. Such guidance entails theoretically no expenditure of energy and so does not conflict with the law of energy-conservation; but it conflicts with the conservation of momentum, and is therefore contrary to the laws of motion, as we have already seen. It is, in fact, the Cartesian *influxus physicus* which Leibniz exposed. Yet it remains the conception most in favour with those who see the absurdity of conscious automatism. But again I say even this conception is incompatible with the thoroughgoing mechanical theory of things. If the facts of life and mind discernible in the external world lead up to such a view, then those facts must lead us on

[1] *Microcosmus*, Engl. translation, vol. i, p. 261 (amended).

also to deny the Cartesian dualism. The contradictions of psychophysical parallelism amount so far to a proof that mind and matter are not utterly disparate and distinct. For guidance is impossible if all the beings concerned in the objective universe are inert masses. To this conception then we are brought back once more. Is inert, dead matter everywhere; is it anywhere? Everywhere, Naturalism tries to believe. Nowhere, the idealist maintains. But if it is not everywhere, then either there must be two worlds, one world of inert masses, and another of living things, or a single world in which these somehow interact. In the former case we belong to the second world, and can neither affect, nor be affected by the first; can have neither knowledge of it nor interest in it. In the latter case, where living things and dead matter belong to the same world, then, if the physicist could completely solve the problems he sets himself, he would find some or all of his laws of motion sometimes set aside. Psychophysics would then become a real science, unless indeed the actions of living things — described perhaps as the movements of self-directing masses, perhaps as the movements of self-directing 'monads' that had no mass—displayed no kind of order whatever.

Again, on the view to which Naturalism clings, in a complete world of dead matter, there would be nothing but a mechanism, but there would be no machines: to talk of collateral products of an epiphenomenal order would be stark absurdity. But let us turn again to the actual external world, and even from the standpoint of natural science, what do we see? Surely the very first distinction that meets us is this very one

of living and dead things. Here I pick up a stone and call it dead: I toss it from my hand and can describe the path it will take. There I pick up a bird: I can toss that from my hand too, but cannot foretell its course through the air.* From that stone, *just as it is*, the physicist derives his idea of inertia. But from the bird, just as it is, he declines to accept the idea of self-direction. Rather calling upon us to accept *his* ideal of mass-elements, he says, Magnify space and time indefinitely and the bird will turn out to be but a vast system of inert masses, devoid, like the stone, of self-direction and obeying only the laws of motion. How does he know this? Suppose we suggest the opposite procedure of diminishing space and time indefinitely till the stone and its motions become infinitesimal, how does he know that the whole sidereal system will not then turn out to be more like the bird than the stone, an organised whole manifesting life and self-direction? The one supposition seems just as reasonable as the other.

It must be candidly confessed that, however much we insist on the fact that mind can direct and control inert mass, we are quite unable to analyse the process. In our ignorance the simplest statement is the best, and I can think of none simpler than saying that inertia, always a hypothetical and abstract conception, perhaps never applicable to anything in the world of concrete things, is certainly not applicable to everything. We must remember that matter and inert mass are not identical, and that the physicist, though he attempts to describe all he knows of matter in terms of mass and motion, is careful to say at the outset that "we do not

* See Note vi, p. 607.

know and are probably incapable of discovering what matter *is*."[1] Unfortunately, before he reaches the end of his story, this preliminary *caveat* is too often forgotten: Professor Tait, for example, who makes this statement, has hardly begun his exposition before he tells us that "matter is simply passive,"[2] thus identifying matter with mass. But 'a mass' means merely a concrete number, *i.e.* the term stands for a specific quantity not for a concrete thing; mass is a mathematical conception devised solely to facilitate calculation, and was never meant to aid rational insight or understanding.

But calculation will never content us; rational insight, spiritual light, is what we want. Imagine a man reflecting upon the actual world as it lies as a whole before him, bent on seizing its meaning, seeking to frame a clear and distinct picture, a *Welt-anschauung*, a world-intuition, as the Germans expressively say, not merely a world-formula. The starry firmament above him, the moral law within his breast, fill him with awe, the meanest flower that blows gives him thoughts that often lie too deep for tears. Imagine such a man saying:—"Here in the impact of two stones I discern the secret of the whole! Just as far as I can resolve all into this, just so far can I say that I see and understand. Here is the promise and potency of every form and variety of life! To this an ultimate analysis brings us down, and on this a rational synthesis must build up." Whereunto shall we liken such a man, and with what can we compare him? Surely, having eyes he sees

[1] Tait, *Properties of Matter*, p. 14. Cf. Lecture II above.
[2] *o.c.*, p. 5.

not, having ears he hears not, neither can he understand. But there is no such man, you say; I know well that there is not. But there is such a system of thought, of which this is the logical outcome, and Naturalism is its name. The man of science, like Frankenstein, has conjured up this monster; and now pretending to have made *him*, it pronounces him to be impotent, and the Nature it presents, to be the only One and All that he can ever know. How is this spectre to be dispelled? Most effectively, surely, by considering how it has arisen. To this end, again, it seems obvious that we must go back to the concrete world as a whole.

We may now first of all lay it down as a canon, that to understand the world as a whole we must take it as a whole. But such a canon Naturalism has defied again and again. To begin, there is this dualism of mind and matter, and its consequence, the fruitless endeavour to reunite what has never been experienced asunder. But that problem, closely as it is connected with the one immediately before us, we have nevertheless agreed to defer. Meanwhile, taking Naturalism on its own ground, and assuming the distinctness and the primacy of the external world: here again our canon is set aside, when qualities are all resolved into quantity, and all relations but the mathematical discarded. Descartes here, as before, is the first and chief offender. His grand conception of science as *Mathesis Universalis* has never ceased to fascinate—and to mislead. Some of the consequences of this error it has been our business to trace; and in that stupendous house of cards, Mr. Spencer's Synthetic Philosophy, we have found an

impressive exhibition of them. As to the fascination of such a conception, the reason for that is not far to seek. It is simply the intuitive clearness of mathematical form and the boundless possibilities of geometrical construction. Here, and here only, the human intellect seems to be in possession of archetypal ideas, and to approximate to the creative intuition attributed to the Deity. The metaphysical obscurities of substance and cause, of being and becoming, do not intrude into this region. A spatial plenum or ether seems to afford us the unity and permanence of being without its mystery; in motion we seem to have change without its contradictions; and differential equations seem to yield us necessary interdependence without any causal nexus.

But, alas, for the vanity of human dreams! though everything that is has quantity, has spatial and temporal relations, there is nothing that entirely consists of these. When a given whole resolves into an aggregate of parts, these again have quantity, have spatial and temporal relations, but again they are more than these. Proceed we never so far, the same remains true; only in the limit to which thought will carry us, but to which experience gives us no warrant to go, we reach at length an empty world, not a world of *things having* mathematical relations, not an actual world at all, but a world of conceptual possibilities of mathematical relations. There the principle of least resistance is the supreme principle of change; there masses can be moved but need not be; there energy can be transferred but need not be; there masses are invariably passive, and energy is invariably directionless. Such conceptions may

furnish an admirable descriptive scheme of "the motions that occur in nature," but they explain nothing. In place of explaining they regress *ad indefinitum.* As they can give no account of any distribution of mass and energy, save by reference to a previous distribution, they have no title to deny interference, but only to admit that they are inadequate to deal with it. So long as things are left to themselves, mechanical principles can tell us what will happen at the next instant, what will tend to happen indefinitely, provided always the mechanism is left to itself. On this large assumption they can predict, but on this only. In a world so framed sentient agents would have means for their ends; for them such a world would be one of law and order. In itself it would be a chaos abated only by quantitative determination. How absurd, then, to make all the life and action of such sentients but the epiphenomenal shadows of vortex-motions in such a chaos! Chaos I call it, for the world described strictly in mechanical terms can have not a vestige of meaning. There is exactness, there is precision, but there is no true unity and no sense.

But let us go back once more to the actual world as it confronts us while we live and struggle in it: avoiding abstract formulation and seeking a concrete acquaintance, what do we find? Certainly nothing that suggests its ultimate resolution into homogeneous mass-points mechanically interconnected. Keeping strictly to the concrete and historical, everywhere we find variety, diversity, whether we carry our gaze into the depths of space or back in time through the geologic eras of the remote past, whether we compare the trees of a

forest or the leaves on a tree, the pebbles at our feet or the mountain peaks that pierce the sky. We content ourselves with merely counting our cattle or sheep, only when we have no individual acquaintance with them; but even on a cursory glance differences appear, and the more intimate our knowledge the more individuality obtrudes itself. Even where the minuteness of objects hides their individual differences from us, we frequently have evidence that such differences are there. Thus the spores of half a dozen ferns sprinkled on the hand look all alike; but sow them, and both specific characters and individual traits will presently shew themselves. In short, so surely as we can find means to perceive the particular thing or particular event, so surely individual characteristics, *hæcceities* as the schoolmen said, emerge to view. I see no reason to doubt that this would hold true even of the five hundred billion light-waves said to reach the eye in a second, if only we could magnify time sufficiently to note and compare them one by one. Just in proportion as things elude our perceptive power or fail to interest us, do proper names give place to common names, and common names to stuffs; biography becomes history, history chronology, and all the teeming life of things but cosmic process. Experience, then, justifies the doctrine of Leibniz: No two things are entirely alike, and no two things are entirely different. An adequate and intuitive knowledge of the world would embrace both these aspects, and so doing would present the world in its true and concrete unity. Scientific knowledge, however, is neither intuitive nor adequate, but always more or less general and sym-

bolic; its general concepts and symbols representing the likenesses among individuals and the likenesses among these likenesses, so tending indeed towards an abstract and spurious unity, but farther and farther away from the living whole. It begins by leaving half the truth aside, viz., that no two things are entirely alike; and natural science further leaves half the facts aside, or rather an essential part of every fact, in ignoring mind and its manifold implications. Setting out from such a dualism and advancing in this abstract fashion, can we wonder that we end in a blank mechanical scheme diametrically opposed to everything teleological?

The surest way to exhibit the philosophical deficiency of such a scheme is to proceed to reconstruct the concrete world by starting from it. For this Balaam's mission Mr. Spencer has been destined, and admirably he has done his work. So long as Naturalism continues in vogue, so long, I cannot help thinking, Mr. Spencer's great enterprise is its best refutation; while, on the other hand, had that enterprise succeeded nothing could have established Naturalism more convincingly. Hence it seemed to me imperative to examine the Synthetic Philosophy in some detail, and to shew clearly the looseness of its ideas and its grave defects of method. I confess the task was not difficult, and certainly was not congenial; but it had to be done. We saw clearly, I trust, that Mr. Spencer's entire performance was a sort of philosophical sleight of hand. Sweep the board, he says, leave me only the universe in a diffused, imperceptible state, and setting out from the persistence of energy, I will shew you how celestial bodies, organ-

isms, and societies, must arise.[1] We saw, clearly, I trust, that with such data Mr. Spencer could not get beyond what he terms the primary distribution of matter and motion, the return of his diffused universe in the shortest and easiest ways back to equilibrium; that, on the other hand, the so-called secondary distributions which are to be the source of celestial bodies, organisms, and societies, one and all imply guidance, direction, and selection — conceptions that inert mass and directionless energy can never by any possibility yield.

Passing on to biological evolution over a gap of two octavo volumes, still missing from Mr. Spencer's work, we came to biological evolution as specially expounded by Lamarck, Darwin, and their successors. Natural selection, taken alone, as Wallace urged and Darwin himself allowed, is only a negative and destructive principle; in 'struggle for existence and survival of the fittest,' on the other hand, we found that striving not merely to live, but to live well, which first gives natural selection its '*point d'appui*.' Here we have a teleological factor, and one suggesting not indeed a nondescript force called vital, but a psychical subject endowed with feeling and conation. Feeling and conation answer to the psychological principle of self-conservation; when to these we add cognition, we reach what I proposed to call the principal subjective selection, the counterpart and supplement of natural selection and the source of a different order of species; to wit, species of environments.

[1] Cf. Descartes' invitation to the reader of his *Le Monde*, à sortir de ce monde, pour en venir voir un autre tout nouveau qu'il fera naître en sa présence dans des espaces imaginaires.

But in the way of all this stood the theory of psychophysical parallelism which has just occupied us, and the contradictions of which, if it be taken for anything more than a methodological convention, I have endeavoured to set forth. Those contradictions compel us to suspect the thorough-going dualism, which renders the interaction of mind and matter inconceivable, and we have seen that, from Descartes' day to our own, it has never been consistently maintained. Invariable concomitance means causal connexion somewhere and a fundamental unity of substance at bottom. Naturalism is driven to assign the causality to matter and to treat mental 'epiphenomena' as its collateral products. We have seen many reasons discrediting this position, but it still remains to be examined *ab initio*. In the endeavour to defend the priority of mind, and to reduce *matter* to the epiphenomenal, or phenomenal as we may be content to say, we shall break with Naturalism once and for all. So far our part has been merely that of critics of its constructions. Hereafter its ally, Agnosticism, will meet us as the critic of our own.*

* See Note vii, p. 607.

PART IV

REFUTATION OF DUALISM

LECTURE XIV

GENERAL CONCEPTION OF EXPERIENCE

The discussion of Psychophysical Parallelism has led up to the formal side of our subject: we now ask, What is natural knowledge and what does it imply?

Naturalism assumes a dualism of phenomena and epiphenomena, the former having the primacy. But the 'real world' from which it starts is epiphenomenal. How then does it get to its *'real world' of matter in motion, and, having got there, how does it get back?*

The perplexities of dualism have brought into favour an agnostic monism or 'revised materialism.' If we are to transcend dualism and this monism, it will be by making knowledge, or rather experience itself, an object of reflexion. Neglect of this question by natural science, psychology and the pre-Kantian metaphysics.

What we find is not a dualism of mind and matter, but a duality of subject and object in the unity of experience.

Experience does not begin with a disconnected 'manifold.'

Sensations not 'subjective modifications' nor devoid of all 'form.'

Relation of subject and object: is it causal? Ambiguity of terms. 'Objective' used from two standpoints. Various attempts to treat this relation as causal noticed.

THE doctrine of conscious automatism, popularised in this country by the late Professor Huxley, is the crowning tenet of Naturalism, the logical outcome of that theory, for which Descartes prepared the way, the

theory, that is to say, which regards the material world as a self-contained whole, primary fundamental, and independent of mind. Minds, then, come to be looked upon as secondary and episodic, merely collateral products, that arise as often as matter falls into the appropriate condition, merely *psychoses*, that are powerless to react upon their concomitant *neuroses*. The confusions and contradictions involved in this assertion of the impotence of mind to control matter we have already discussed at length. The assumed primacy and independence of the automaton still remained to be considered. But I propose now to merge this in the broader question and to examine generally the assumption of naturalism that physical phenomena are our primary facts and facts independent of mind. To do this will entail some change in our method of procedure.

At the outset of this course (in the second lecture), it was remarked that our knowledge of nature, as unified and systematised in the sciences, may be examined from two sides: either *formally* as knowledge, in respect of its postulates, categories, and the like; or — taking these for granted, as science itself does — this knowledge may be examined in respect of the *real* principles to which its supposed unity and completeness are ascribed.[1] We began with this latter side and have dealt in turn with the mechanical theory, the theory of evolution, and the theory of psychophysical parallelism. And now at length our discussion of the last of these real principles brings us round to the formal side and leads us to ask: What in itself is natural knowledge, and what does it

[1] Cf. Lecture II.

imply? For this is the problem really involved, whether we challenge the particular doctrine that man is primarily an automaton and his consciousness but an epiphenomenal *aura* that accompanies its working, or challenge, as I now propose, the more general doctrine, of which this is but the logical consequence. According to that doctrine, if we are to exhibit the sum of things from the beginning and connect each to each completely, we must start from matter and motion. To this, Mr. Spencer in effect has told us, "an ultimate analysis brings us down and on this a rational synthesis must build up." Of the same tenor are some words of Huxley which I have already quoted and will take leave to quote in part again. "In itself," said Huxley, "it is of little moment whether we express the phenomena of matter in terms of spirit, or the phenomena of spirit in terms of matter. . . . But with a view to the progress of science, the materialistic terminology is in every way to be preferred. For it connects thought with the other phenomena of the universe, . . . whereas the alternative, or spiritualistic terminology, is utterly barren, and leads to nothing but obscurity and confusion of ideas."[1]

To be sure such deliverances are usually guarded by agnostic disclaimers of any knowledge as to what matter is, or what spirit is, and usually too by indignant repudiations of 'what is commonly understood by materialism.' Such materialism as that of Hobbes or of Holbach, for example, is certainly no part of the naturalism of to-day. So far from saying that mind is a mode of

[1] *Collected Essays*, vol. i, p. 164.

motion, it scouts such a notion as sheer absurdity. This breach with the old materialism, to which Agnosticism has led, is, we have allowed, a distinct advance. But after all, if Naturalism is to stop at this, what have we but the substitution of one materialism for another? What avails it to know that mind is not actually itself matter in motion, if we must believe that it is as much bound up with such motion as the shadows and the whirring of its wheels are bound up with the working of a machine? If Spirit is to be derived from Nature and not Nature from Spirit, if 'the materialistic terminology' is the one means of rational synthesis and the spiritual leads only to confusion of ideas, what is the good of saying that both are symbolic? Something must be real, and the plain implication so far is that 'the materialistic terminology' brings us nearest to that. This is the position that we have now to examine, and on account of which we must inquire into the character of natural knowledge.

For the common-sense man, and for all men in their ordinary life and intercourse, the world each one lives in is a world of things that are seen, felt, and handled, a world of sensible objects, some of which we seek and use, while others we neglect or destroy. This is the world of 'naïve realism,' as philosophers say. But from the standpoint of naturalism a world described in such terms is epiphenomenal. The 'real world' of science, the world of phenomena, on the other hand, is a world of mass-points transferring and transforming their motions, a world of quantitative diversity only. Now philosophers, as we all know, have long vexed themselves

with the endeavour to resolve the contradictions of unreflecting common sense, and to ascertain the veritable reality of this external world that we perceive. These ontological essays the agnostic derides as futile; for of reality as distinct from appearance, we can, he tells us, know nothing. He repudiates the materialistic *philosophy;* but holds, nevertheless, that we have done the most and the best that can be done when, accepting 'the materialistic *terminology*,' we conceive the world in terms of matter and energy and their evolutions. But we have seen Naturalism, which undertakes this task, unable to complete it, and breaking down hopelessly when the complete facts of life and mind have to be taken into account. The naturalist cannot get back to himself as a living, thinking, acting being. In his desperation he begins to blaspheme — I mean he begins to talk metaphysics — much to the discomfort of his agnostic ally. So he comes to speak of monism, of mind and matter as comparable to the concave and convex aspects of one curve, and the like. Then the agnostic persuades him that what answers to the curve as distinct from the aspects — if indeed anything does — is unknown and unknowable. Meanwhile, his own standpoint is the outside of the curve, the material aspect. Its terminology compels him to affirm that interference or spontaneity is impossible there; and so the talk of conscious automatism, collateral products, and epiphenomena arises.

The final collapse of this enterprise now leads us to ask: How did the naturalist ever get across 'the ugly broad ditch,' over which he now finds no satisfactory return? To this comparatively simple epistemological

question some physicists, as we saw when discussing the mechanical theory, are now beginning to attend. They openly proclaim that mass-points and frictionless media are not phenomena, but merely descriptive hypotheses, that can never be verified as facts; hypotheses that would at once become obsolete, if simpler and more workable conceptions should be found. Yet Naturalism pays little heed to these admissions, and even less to the consequences that they entail. Moreover, even among physicists, to say nothing of other men of science, there are many who believe—like one I have had occasion to quote—that "what actually goes on behind what we can see or feel" is these very motions of mass-points so often described. But the objects of sight and touch at any rate are phenomena; while it is certain that no one ever did, or ever will, see or feel the motions of mass-points or of vortices in a frictionless fluid. Naturalism, we remember, is too wise to claim for these supposed actualities behind what is perceptible any non-phenomenal, noumenal, or metaphysical reality. But if neither perceived nor perceptible, how then can they, with any propriety, be called phenomena? If they are not empirical data, how then has the physicist got at them? There seems to be but one answer to these questions, and happily in this all those physicists are agreed who have in any way troubled themselves with such epistemological inquiries. These supposed actualities, behind what can possibly be seen or felt, are not only not absolute realities, they are not even phenomenal realities; they are simply conceptions which the physicist has reached by idealising what he *can*

see and feel. It is plain that if this be the truth, then those prime and ultimate phenomena of Naturalism are, after all, but epiphenomena, thoughts not things, ideas existing solely for the minds of physicists, and serving only to interpret and connect what we actually see and feel, that is to say, other epiphenomena.

But what then is the force of the 'epi,' and what becomes of the primacy of 'the materialistic terminology'? The tables seem to be completely turned. What we see and feel, the facts of perception, become the real phenomena. Instead of states of consciousness supervening upon certain motions of mass-points or some peculiar complex of ethereal vortices, these motions, etc., prove to be but ideal conceptions superimposed upon phenomena by the mind that seeks to connect them in respect of their quantitative relations. So far from connecting "*thought* with the *other* phenomena of the universe," as Huxley maintained, these conceptions are themselves simply thoughts connecting those 'other phenomena' together. But the connexion of such 'other phenomena' with thought and consciousness is a wholly distinct question and one that is left entirely aside.

This complete scission is in fact the πρῶτον ψεῦδος of all dualistic speculation; and Naturalism does not escape its consequences by hearkening to the voice of Agnosticism, and substituting phenomena and epiphenomena for the Cartesian substances, matter and mind. The first step of all is easy to take; indeed, it is taken unconsciously; for science sets out from the naïve dualism of common sense. But when it has gone farther and farther, till at length only a system of mass-points

or a homogeneous plenum, in motion is left, then the problem consciously to retrace the many steps that have been taken proves hopeless. But it is said: "Phenomena empirically given were our starting-point; observation, experiment, deduction, and verification have accompanied every step; at what point then have the phenomena ceased to be phenomenal? As we have advanced we have but got nearer to the realities — phenomenal realities, of course, of which our sensory presentations are merely the symbols." Such is the language of Naturalism on the way out; so it becomes committed to a doctrine of phenomena *per se*, surely a more glaring absurdity than that of things *per se* can ever be. The true answer to this challenge, as I hope we shall see, is to say that the phenomena ceased to be phenomena at the very initial step when percept and percipient were sundered; that the further steps consisted not of percepts but of concepts, which as abstract may have — and indeed have actually — a certain relative validity, but no reality. The very ruthlessness with which its mathematical methods hurry it onward to such ultimate abstractions as Boscovich's centres of force or Kelvin's homogeneous plenum, yields perhaps the most convincing proof that after all we can *not* set out to synthesise rationally by the aid of a 'materialistic terminology.' And when Naturalism, oblivious of all this and still regarding these mechanical abstractions as real, attempted to get back to mind, we might safely have said that it was foredoomed to the failure that has in fact overtaken it. There can be no "promise and potency of life" about mass-points changing in nothing but position and velocity, and *that* only

on external compulsion. There is no mystery about geometrical points and their movements; yet no sooner is there attached to them the notion of inertia and the name of matter, than we are asked to regard them as the unknown and hypothetical cause of states of our own consciousness. Not — we are again assured — that consciousness inheres in the inert mass or is identical with its movements, as the crass and dogmatic materialist of 'the bygone slime' foolishly imagined. No, states of consciousness pertain to a distinct but parallel aspect of these molecular motions, albeit a secondary and, for them, a contingent aspect. But where, we have asked, is the room for another aspect of such moving points? So long as matter was left with an untold residuum of active properties, as by materialists like Priestley, the annexation of thinking to matter was not so obviously absurd, for such matter might prove to be mind at bottom. But Agnosticism forbids such speculations; moreover, the increased exactness and precision of the materialistic terminology leave no room for them.

The result then to which we seem to be led is briefly this: The external world, as it is presented to us, and to which each and all of the naturalist's observations and experiments belong, is the true world of phenomena. This world cannot be severed from the minds that perceive it, and yet remain phenomenal; neither can it be completely and adequately explained or described in materialistic terminology. As the proximate phenomena presuppose perceiving minds, so do the so-called ultimate phenomena, involving pure space, uniform time, inert mass, and energy, presuppose intelligent minds that have

elaborated these conceptions, though they have never experienced such realities. The assumed primacy of the physical as against the psychical is due, first, to the fact that in his absorption and interest in the objective attitude the naturalist has forgotten *himself;* and next, to the fact that he has mistaken his abstract conceptions for presented realities. The notion of an epiphenomenon supervening on physical phenomena is in flagrant contradiction with the mechanical conception of a closed system of connected masses. From the standpoint of physics itself such a notion could never arise; while from the wider standpoint of psychology, to regard mind as the collateral product of its own external perceptions is simply to invert the facts. One might as well say that reflexions produce their own mirror, or that houses evolve architects. We are led, in a word, to doubt that mind and matter can be dual realities, either phenomenal or ontal, and to doubt further that, if they could be, matter would be first. The dogmatic Naturalism of a former age asserted this priority of matter as a substance; the agnostic Naturalism of our own time asserts it of matter as a phenomenon. Of the two positions that of the thoroughgoing materialists is logically far the more consistent. It is besides a position from which Naturalism has been unwillingly driven, and hence the traditional bias still remains. Evidence of this bias we have seen in the frequent lapses from the unstable equilibrium of psychophysical parallelism towards this primacy of the materialistic standpoint. Further, as Naturalism has had to abandon that old stronghold of dogmatic materialism, and can now only talk of matter as 'the unknown

and hypothetical cause of states of consciousness,' it is loud to proclaim *en revanche* that spirit is also but 'an unknown and hypothetical cause, or condition of states of consciousness.' Even in these phrases of Huxley the materialistic bias shews itself: matter is honoured as *the* cause, spirit is referred to only as *a* cause *or condition*, and then both are grouped together as 'imaginary' substrata of groups of *natural* phenomena. But this Agnosticism, which cannot be materialistic and will not be idealistic, at any rate serves to exhibit the superfluity of a dualism of substance; for why say there are two substrata, if both are unknown? It explains too how it is that monism has become the order of the day. A glance at that enterprising and significant journal, *The Monist*, will shew how eager scientific men are to help in the new construction.

This demand for monism by scientific men who reject the old materialism is in itself a hopeful sign. In discussing psychophysical parallelism we have had to notice this movement. It then, however, became apparent that we cannot hope much from a monism that sets out from two totally distinct and disparate orders of phenomena, least of all when the spontaneity that belongs to the one is declared to be illusory or impotent, solely in order to save the inertness which is held to be the essence of the other. Nor again can we reasonably content ourselves with a monism which, however anxious not to be called materialistic, yet disclaims the title of idealistic or spiritualistic with even greater vehemence, being unwilling at any price to part with its mechanical scheme.

Two questions then here present themselves: (1) Can

we transcend this phenomenal dualism, or is it ultimate and inevitable? (2) And if *that* is not ultimate, can we then also get beyond agnostic monism, with its materialistic bias? In some form or other these are among the oldest and most intractable problems of philosophy; what likelihood is there, therefore, that we shall succeed in our day, when long centuries behind us are strewn with failures? Of course I do not for a moment suppose that the last word will be heard on these questions in our time; certain I am that the *dicta* of Naturalism and Agnosticism will not end the quest. Nor can I admit the ignorant commonplace that philosophy has made no progress.[1] And progress is all that we can look for: finality from the nature of the case is impossible. As I urged in the first lecture, relative knowledge implies relative ignorance, and relative ignorance again implies soluble problems. Now the function of philosophy, we are often told, is to organise and unify knowledge. To this end it is before all things necessary to make knowledge itself an object of reflexion and study. This science does not do, and—what is worse—the dogmatic metaphysics of Descartes, on which the whole fabric of modern knowledge long rested, did not do it either. As a consequence, the dualism of things mental and things material, *res cogitantes* and *res extensæ*, has been a problem for the critic of knowledge ever since. It ought not to be thought presumptuous if philosophers claim that during these two centuries of reflexion on that problem they have made some progress.

Psychology and the natural sciences advancing inde-

[1] Cf. my article "The Progress of Philosophy," *Mind*, O.S. xiii, pp. 213 ff.

pendently on the basis of this dualism have, as we have seen, only widened the breach. For natural science the question was how to get from matter to mind; the attempted solution by the hypothesis of psychophysical parallelism we have found defective and unsatisfactory. For psychology the question was how to get from mind to matter, the problem, in other words, of external perception. The result, again, I am bound to say, is defective and unsatisfactory. Shut in within a circle of ideas, how could the mind know the things beyond, which this very circle shut out; how could it trust the copies if the originals were forever beyond reach, nay, how know that there were any originals at all? Such were the questions raised in particular by British thinkers, from Locke to Reid. These were the questions which Locke slily remarked "seem not to want difficulty," and which Hume boldly declared hopelessly insoluble; while to resolve them Berkeley denied Descartes' outer circle of things and Reid his inner circle of ideas.[1]

Meanwhile the rationalistic thinkers of the Continent, setting aside sense-impressions as too obscure and confused to afford immediate knowledge, looked to clear, distinct, and orderly thinking as the one method by which knowledge was to be educed. This procedure too proved futile and disclosed its essentially formal character, when Wolff at length made the law of contradiction the cardinal principle of his philosophy. Then came Kant, and the question of external perception was taken up into the wider one of the nature of experience. For so we may broadly characterise the

[1] Cf. Fraser, *Life and Letters of Berkeley*, p. 386.

inquiries of his three critiques; since all that we know and feel and do, all our facts and theories, all our emotions and ideals and ends, may be included in this one term — experience.

It is then by raising this question as to the nature of experience that, as I think, we shall see the untenability both of dualism and of the neutral monism that is nominally to supersede it. I have mentioned Kant, not because I propose to follow him in detail, but because he first raised the right question, avoiding in the main the one-sidedness both of his sensationalist and of his rationalist precursors. There are active as well as passive factors in experience, and the pre-critical philosophers had tended each to emphasise only one. To carry the mind beyond itself Locke's *tabula rasa* was as helpless in the one way as Leibniz's windowless monad was in the other. But Kant, though he made both sensibility and understanding essential to knowledge, yet failed to make a satisfactory unity of the two. His 'affections of the sensibility' were only Locke's impressions over again. Between the aggregate of these affections and the independent functions of the understanding, he did not succeed in establishing any true organic connexion. His matter of knowledge and his forms of knowledge stood too much apart; the result was too much that of sensationalism and rationalism placed side by side, rather than the complete reconciliation of both. Still it was his problem, taking experience as a fact, to render it intelligible, and he entered upon this, not by assuming a dualism of matter and mind, but by insisting on the duality in unity of subject and object. And with this we too must start.

Let no one hastily conclude that between this duality and that dualism there is only the faintest verbal difference, that subject and object are but mind and matter under other names. According to the Cartesian philosophy, of course, mind and matter were not only distinct and disparate, but absolutely separate and mutually independent. Their union in fact was a miracle, and so, for science, a stumbling-block; and one, too, which the various hypotheses of occasionalism, preëstablished harmony, psychophysical parallelism, have severally failed to surmount. But at any rate there cannot be this great gulf fixed dividing one part of experience from another. We may ask how such conceptions as matter and mind have arisen and discuss their validity, but we cannot set out from this dualism as if it were a fact.

There is for each but one experience, his own; and an experience that is not owned is a contradiction. We can assign no *boundary* to our experience without at once extending it in thought, and thought itself involves experience. Hence the phrase, 'content of experience,' or 'content of consciousness,' is apt to be misleading. The experience of one is not limited by the experience of another as one portion of time or space is limited by another portion of time or space. The continuity of experience is not then determined from without. Experience is rather an organic unity that we always regard as self-maintained. In a word it is life, *βίος*—life as it is for the living individual, not life, or *ζωή*, the interaction of organism and environment, with which the so-called biologist is exclusively concerned, and where both organism and environment are objects for a distinct

observer. It behoves us therefore to take all possible pains to keep these two very different standpoints distinct. Psychology, as I have already remarked earlier in these lectures, has been most seriously hampered by confusing them.

We start then with this duality of subject and object in the unity of experience. What a subject without objects, or what objects without a subject, would be, is indeed, as we are often told, unknowable; for in truth the knowledge of either apart is a contradiction. It is their unity that specially interests us, for we look to this to free us from the perplexities of dualism. Some current conceptions of this unity I feel bound to controvert. First of all it is held and rightly that to a given experience or life there can only be one subject, but that —and to this I demur—there must be many objects. The unity of experience pertains to the objective as well as to the subjective. According to Kant, it will be remembered, experience begins with a mere manifold or disconnected multiplicity of sensations, which are then synthesised into a temporo-spatial continuity. Disconnected in a logical sense this manifold may be, but psychology, I trust, has outgrown this notion of isolated particulars or 'mental atoms,' somehow strung together on a 'thread of consciousness.' Whatever development or differentiation an individual experience may undergo, it does not *become*, but always *is*, a unity. Sensations are not like grains that the subject picks up, but changes in an objective continuum that is always there as an unbroken whole, however indefinite as respects boundaries. I am loath to dwell on this point, partly because I have done

so already elsewhere,[1] and still more because it is coming to be generally conceded. I pass then to another more open to debate.

Sensations are commonly described as subjective affections or modifications. Such language has, by the way, the incidental advantage of disowning by implication the atomic conception of sensations. But are these primary presentations subjective? From one point of view this language is perhaps justifiable; it is at least convenient. In a sense all A's experience, *quâ* his and not B's, is subjective; and particularly in the sensations of either there may be peculiarities or idiosyncrasies that are undiscoverable and incommunicable. Nevertheless, I contend that the sensory and motor changes or processes entering into each conscious experience are objective for the subject of that experience; inasmuch as they can be attended to or apprehended, liked or disliked. For cognition they are a 'this' and a 'what'; for volition they have a 'worth.' To say that sensations and movements are, from the point of view of individual experience, modifications of the subject, forces us further to say, either that they are originated by the subject, or by what we commonly call objects, or by an unknown thing *per se*. All three alternatives have had their advocates. The first and third, the theories respectively of Fichte and Kant, are attempts to render experience intelligible by transcending experience; the one on the side of the subject, the other on that of the object. These, as they stand, have satisfied nobody. Even Fichte had to allow the duality of subject and

[1] *Encyclopædia Britannica*, article *Psychology*.

object within experience, and Kant to treat his thing *per se* as a problematic and limiting conception. The second alternative is that of ordinary thought. The material thing we call an orange is commonly regarded as an independent 'real,' that gives rise in each percipient to his sensations of colour, taste, and so on. But this, as it stands, is just the theory we have found to break down, the theory that rests on the dualism of phenomenon and epiphenomenon, and leads to all the difficulties of psychophysical parallelism. It presupposes, too, that very primacy and independence as pertaining to the physicist's external phenomenon, which we have seen reason to disallow. If this phenomenon is not to be itself a thing *per se*, its own reality consists of just such sensory '*præsentabilia*'[1] as it is supposed to cause. This theory, at any rate, Kant has exploded; albeit, unhappily, he never completely broke away from the Cartesian opposition of mind and matter. He often seems to identify mind with the subject of experience on the one hand, and matter with the object of experience on the other. There could hardly be a greater mistake than this identification; for the duality in unity of subject and object at once lapses, and the old gulf between thinking substance and extended substance, between external phenomena and internal epiphenomena reappears.

It is safer to leave the terms matter and mind aside for a time, and to keep strictly to the facts of experience. But, if we must talk of mind, let us beware of accepting the descriptions current among psychologists.

[1] An awkward, but useful, word of Helmholtz's.

They may be admirable as rough approximations for expository purposes, but even then are apt to confuse. Thus no less eminent a writer than Dr. Bain suggests that, "Mind is definable in the first instance by the method of contrast, or as a remainder arising from subtracting the Object World from the totality of conscious experience."[1] But when he reaches our present problem of external perception he is careful to add: "There is no possible knowledge of a world except in reference to our minds. Knowledge means a state of mind: the notion of material things is a mental fact. We are incapable even of discussing the existence of an independent material world; the very act is a contradiction. We can speak only of a world presented to our own minds."[2] And, of course, this is the statement we should prefer to accept; but then, it reduces the preliminary definition to a contradiction, in so far as conscious experience without objects is such. Again, whereas the later statement recognises the fundamental unity of experience in the duality of subject and object, the earlier explicitly contemplates its separation into two kinds — subject-consciousness and object-consciousness. But there must be an objective side to the subject-consciousness, and a subjective to the object-consciousness. Are the subjects then identical, and how are the objects related? The objects of the subject-consciousness, we should be told, are those of an individual experience only; the objects of the object-consciousness are those which other subjects participate in experiencing. We may safely accept this answer; it leaves us free

[1] *Senses and Intellect*, fourth edition, p. 1. [2] *Op. cit.*, p. 399.

to treat sensations as essentially objective, and only brings out the fact just now mentioned, viz., that the term objective is ambiguous till we know the standpoint from which it is used. What is psychologically objective is often treated as epistemologically subjective, as it is by Kant, for example, continually.

One further point by way of elucidating our claim to treat sensations as objective. Such a claim is often disallowed on the ground that sensations pertain really to feeling and not to cognition; or again on the ground that they are the *matter* of experience simply, whereas the objects of cognition must have *form*. This, as we know, was substantially Kant's position, and made it easier still for him to slide into defining sensations as subjective affections. But the farther progress of psychology since his time has, I think, fairly routed this whole position. Sensations *have* form; in other words, they have inalienable characteristics, quality, intensity, extensity; as people say again nowadays, they have a 'what' as well as a 'that.' Again, they are not isolated; but, as I have already urged, they are changes in what — for want of a better word — I have been fain to call a presentational continuum. The so-called 'pure sensation' of certain psychologists is a pure abstraction; as much so as the mass-point of the physicist, but without perhaps the same warrant on the score of utility. The whole doctrine of the gradual elaboration of perception out of purely subjective material is fast being relegated to the region of psychological myth; but it would carry us too far from our main problem to discuss this in detail here. When Locke treated sensations as ideas, or pre-

sentations, as we should now say, and defined these as "the objects of the understanding when a man thinks," he was really nearer to the truth, than Kant was with his artificial distinction of matter and form. It is physiology rather than psychology that has kept the notion of sensations as subjective affections in vogue. Primary or perceptual presentation is all we mean, and such a term has the advantage of making the objective character explicit, and of ignoring physiological implications with which we have nothing to do.

And now we may pass to another question. If these primary presentations are essentially objective, and not subjective, modifications, what is the relation of the subject to such objective modifications? The subject has several necessary relations to all actual presentations, and to these we must refer presently. But as regards the bare fact of presentation there is nothing to be said; it is that relation of subject to object and of object to subject, in virtue of which they are severally subject and object. As the absolutely ultimate relation within experience we can either say that it is inexplicable, or that it needs no explanation, or we may entertain the notion of an Absolute, in which the unity of experience outlasts the duality. But one thing, I think, we must not do: we must not attempt to bring this relation of subject and object under the category of cause and effect. I do not mean to deny that there are causal relations between subject and object, object and subject —quite the contrary. I only demur to the assumption that the subject-object relation itself is causal. Without meddling with any of the many vexed questions

concerning causation, it is at least clear that causes must be real before they can be causes: also that an effect or consequent cannot give rise to its own cause or antecedent. Causality logically presupposes reality, not reality causality. But subject and object in the unity of experience is the real. If we disabuse ourselves of the psychological fiction of isolated sensations pattering like spots of rain on a *tabula rasa* from an outer nowhere; if we think instead of the objective factor (or presentational continuum) as an unbroken whole — as much a whole as a mere continuum can be — then we see, I think, that this — for experience — absolutely fundamental relation cannot be causal. We ordinarily employ the category of causality to relate one part of experience to another, a change to an antecedent change. Thus in its very form causality presupposes distinction within experience, and accordingly this relativity within experience ceases the very moment that the part coincides with the whole. Similarly we may assign a position to one part of the universe relatively to another, but not to the universe itself. Difficulties, analogous to those besetting absolute time or absolute place, arise when we try to make causation absolute by extending it to experience *en bloc*. And in fact all attempts to treat the relation of subject and object as causal have engendered such difficulties. I referred to these a moment ago; it may be well now to recur to them in more detail. But to prevent misapprehension let me again repeat that the question is not whether any interaction between subject and object is conceivable, but simply whether the relation of subject and object as that presents itself in

the time-worn problem of external perception can be regarded as a causal relation.

First of all let me urge again that, at all events, we have not the warrant of direct experience itself for so regarding it. Those who think otherwise seem to be misled by the ambiguity of the leading terms. Thus mind is sometimes used as coextensive with an individual experience in its entirety, as in empirical psychology, for instance; at other times it is restricted to the subject that has the experience. So, in like manner, subjective refers at one time exclusively to this subject, at others is made to cover both the subject and the totality of its objects as such. But once we clear up this vagueness in our terms, we find no warrant within experience for regarding presentations as modifications of the subject that has them. Comparative psychology, which—according to the usual expositions of the differentiation of subject and object—ought to furnish strong evidence in support of this assumption, is, on the contrary, as Professor Riehl[1] has pointed out, conclusive against it.

But we may still entertain the hypothesis that the immediate objects of experience are ultimately, in some underground way, offsets or emanations of the subject. If we do this in Leibniz's fashion,—suppose, that is, that each several subject evolves its own experience from within,—we have a world which is really no world at all, a world in which there is actually no community or interaction, but only the semblance of them. And even this semblance, as in the famous example of the

[1] *Der philosophische Kriticismus*, 1887, Bd. II, ii, p. 53 f. Cf. James, *Principles of Psychology*, vol. II, ch. xvii, pp. 31 f.

two clocks, is only secured by the altogether extraneous assumption of a preëstablished harmony in the respective developments of the isolated, independent, windowless monads. If we go to the opposite extreme, and, following Fichte in his daring speculation, set out from an Absolute Ego that posits its own Non-Ego, we have then a converse difficulty, as Fichte soon discovered. There is no way for us from such an act to the world of finite subjects, face to face with a Non-Ego which they have not posited. The relation of subject to object in such experience is where it was. We cannot begin from God and construct the universe. Even if we persist in calling the objective factor in our experience a subjective modification, at least we cannot pretend that the subject is the cause of it. There is, perhaps, no point in the whole of philosophy as to which there is such complete agreement: idealist and realist, sceptic and dogmatist, are here almost invariably at one.

Those who treat presentation as a causal relation accordingly look to the object itself as the cause. It is in this aspect that the question "forms the most vital crisis in the whole history of speculation," as Ferrier, in one of his many brilliant essays on the topic, has called it. And had Ferrier been familiar with the Kantian controversies at the close of last century, or had he lived to take part in the neo-Kantian controversies at the close of this, he would have had still ampler grounds for his emphasis than his studies of Berkeley, Reid, Brown, and Hamilton afforded. Kant, as is well known, refers to two orders of objects: objects *extra nos*, or external phenomena, and objects *præter nos*, or things

per se. The former he resolved into 'raw stuff,' mentally elaborated according to the forms of intuition and understanding. To this order the objects of our experience entirely and exclusively belong. Of the second order, the things *per se*, we have not and cannot have any knowledge whatever; neither knowledge that they are nor yet knowledge what they are. Returning now to the raw stuff of phenomenal objects, we ask: What is this, and whence does it come? It consists, says Kant, of sensible impressions or affections; it is produced by objects that excite our senses; in this way only are objects given to us. These objects that are '*given*' to us are, of course, objects of the first order; but of which order are the objects that affect us, the objects that '*give*,' and so set experience going? To this question neither Kant himself nor any of his successors has been able to find a satisfactory and consistent answer. A vast literature has already gathered round the question, and is growing still. Are things *per se*, or are the phenomenal things in space the cause of sensory impressions? This is the question. Whichever way it is answered special difficulties arise; it is therefore not surprising to find, sometimes things *per se*, and sometimes external objects, assigned as the cause of these 'affections of our sensibility.'

If, as Kant in the main does, we put forward things *per se* as this cause, then how can we also maintain their purely problematic and negative character? [1] They become at once not 'the boundary stones' but 'the foundation stones' of experience. We must know *that*

[1] Cf. Drobisch, *Kant's Dinge an sich und sein Erfahrungsbegriff*.

they are; and from the variety of their effects we must surely be able also to infer something as to what they are, as to their nature as causes. In a word, the categories, instead of being confined to the raw stuff of experience, will now have some positive application to these things *per se* which produce it; and these, thus ceasing to be *præter nos*, will become only *extra nos* and phenomenal in their turn. Things *per se* of a higher order now seem called for to account for them, and so on indefinitely.[1] On the other hand, if Kant is to be held to his description of noumena as purely problematic conceptions of what are objects for beings whose intelligence is essentially different from ours, it is idle to speak of them as causes concerned in our experience.

Again, if, as neo-Kantians in the main do, we put forward phenomenal objects as the cause of our sensations, we seem involved in a hopeless circle. "For," as Vaihinger in his monumental commentary remarks, "these empirical objects are according to Kant's thousandfold repeated assurances 'nothing but our presentations.' How then can or should these presented objects first affect us in order that we may obtain precisely the presentations in which alone they consist?"[2] In short, remembering that our question is as to the relation of subject and object generally, this answer is tantamount to saying that the objective element in experience causes itself.

There is still another view that it would be wearisome, and as I think needless, to discuss, which should

[1] Cf. Caird, *The Critical Philosophy of Kant*, vol. i, p. 652.

[2] *Commentar zu Kant's Kritik der reinen Vernunft*, Bd. II, p. 51.

perhaps be mentioned. I refer to a doctrine, now in favour with certain psychologists, that I have ventured to call Presentationism. According to this, there are at starting only presentations, and these by their interaction in due course give rise to a special presentation, or rather complex of presentations, called the subject. Such a doctrine I believe we are entitled summarily to rule out of court till it is made plain to us how there can be an experience with no unity, an experience that nobody has.

So far then may we not say that we have good reasons for not attempting to treat the relation of subject and object as primarily a causal relation? Some further observations on this position and its consequences must be reserved till the next lecture.

LECTURE XV

EXPERIENCE AS LIFE

Recapitulation and further explication as to the general conception of experience. Its fundamental character the whole difficulty: early reflexion misled by imperfect analysis and by deceptive analogies.

Coming to details, we note that every concrete experience is a process of self-conservation, is a Life. *Kant's distinction of 'matter and form' and his 'Synthetic Unity of Apperception.' Conation more fundamental than cognition. Subjective selection determined by the worth of objects rather than by their 'content.' A purely cognitive experience impossible. Practical interests never absent. Even spatial and temporal relations involve elements due to activity initiated by feeling.*

Spatial perceptions and conceptions compared and discussed by way of showing the shortcomings of dualism. Science, concerned only with the conceptions, ignores the elements due to the conative and practical interests of the subject.

A like comparison and discussion of temporal perceptions and conceptions.

The notion of empty space and empty time, as necessary antecedents of the things and events that are said to fill them, is an inversion of reality.

Let us first recall the general drift of our new inquiry. It is to ascertain if there be not some way of escape from that dualism of mental world and material world, in consequence of which the departmental sciences of physics and psychology have during two centuries become more and more severed and estranged from each other. Modern thought finds itself in a

quandary familiar to most schoolboys working a sum, when they bring out an answer which they know cannot be right, while yet they fail to see any fault in their mere arithmetic. Physics in its own department seems to hold together, and psychology in like manner in its department. Also we know that in experience we find nothing of this gulf which yawns between these sciences, and which hypotheses innumerable have failed to bridge. To avoid this 'scandal of philosophy and of human reason,' as Kant called it, we have proposed to leave the special sciences on one side, and to reflect upon that experience as a whole, which they begin by sundering. Like the schoolboy, we try our sum again on a new method; that is to say, we take up the problem of knowledge.

We started from the duality of subject and object as the first essential of experience. In every concrete experience there is one subject; and on the objective side, too, such an experience is one, one life; the subject is continually in touch with one world, one environment. The law of this life is change. Differentiation, development, there may be too; but such life is not a process of integrating particulars originally isolated as well as distinct. Given a subject, or centre of experience, and such an objective complement, then the most salient feature is their interaction—the feeling that objective changes induce in the subject, and the response to which such feeling leads. To these we must turn next. But first, one or two remarks on what has been already said of this bare relation of subject and object, which we have found to be the very

basis of experience. It cannot, we say, be itself a relation of two disparate substances; the unity of experience forbids that. Moreover, the dualism that has brought our 'scientific philosophy' to a deadlock, went wrong in this way. But can we even describe this relation as a modification within one substance; can we say that the object is a mode of the subject or the subject a mode of the object? The attempt has been made both ways, and both ways it has failed. The sensationalism of Locke and the idealism of Berkeley fall, more or less, under the one alternative: the old forms of materialism and the 'presentationism' of certain of our psychological contemporaries belong to the other. The former fails to do justice to the objective unity of experience, and the latter fails, still more egregiously, to do justice to its subjective unity. The attempt again to describe this relation as causal scarcely succeeds better. The subject, no doubt, is active in thought and volition, for example; but thinking and willing presuppose objects: of a subject that either by thought or will posits its own perceptions *we* at least know nothing. Also it is true that one object, or rather one change in the objective continuum, may prove the cause of the presentation of another; so to relate change with change is indeed the special function of the category of cause. But this, like any other relation of particular object to particular object, leaves the more fundamental relation of subject to object just where it was.[1]

[1] Cf. J. S. Mill, *Examination of Sir. W. Hamilton's Philosophy*, third edition, p. 231.

The fundamental and ultimate character of this relation is, in fact, the whole difficulty. Experience is far advanced before even the rudest reflexion about it can begin. Imperfect analysis and deceptive analogies are the first result of such reflexion; and as these become embodied in common thought and language they count for part of the facts, though really fictions that belie them. Thus, the subject being identified with the organism which is but a special object among others, the whole objective continuum is said to be an affection of the subject, because the physical environment affects the body. So we get the notion of sensations as subjective affections, whose causes are still to seek. Then come the metaphysical travesties of inner and outer, which refer originally and literally to space divided into two compartments by a man's skin. But presently, since it is said there is nothing in the intellect but what first came through sense, 'inner' comes to mean the whole of each one's experience as it is for him, the psychical side of his particular brain; inner is then the equivalent of subjective. Outer, on the other hand, is the brain side of this particular subject *plus* all the rest of the external world; in this all sentients alike are supposed to participate. Imagine a dozen genii, each one hermetically sealed in a bottle, but all collectively roaming at large, and you have a fair parallel to this figure of inner and outer.

Or look for a moment at another line, where reflexion shews itself just as confused and incomplete. Touch, from its intimate connexion with muscular activity, is held to present the actual; while sight, despite its pre-

eminence in cognition, being a fruitful source of illusion, is found often to present things as they 'appear,' not as they actually, *i.e.* tangibly, palpably, are. So by an easy step *all* our sensible intuitions come to be regarded as phenomenal; the things *per se*, which are held to be their cause, and by which we might test them, being now out of reach. But how then, we are led to ask, can we speak of such things *per se* at all? And yet the answer is easy, once we are committed to the notion that sensations are subjectively affections, and objectively appearances or phenomena. For the validity of these notions being taken for granted, Kant argues with perfect cogency when he says "that we must have something to correspond to the receptivity of the sensibility."[1] And again that "it follows naturally from the notion of a phenomenon of any sort that something must correspond to it that is not itself phenomenon"; also "that the very word 'phenomenon' indicates a relation to something, the immediate presentation of which is indeed sensible, but which in itself apart from this condition of sensibility, must still be Something, namely, an object independent of sensibility."[2] But the prime question is not what the notions of receptivity and phenomenality implicate; but what warrant these notions themselves possess in experience. And here we can only follow suit and, like the great body of Kant's critics, preach to Kant from himself. Let what may be outside experience, if there can be anything, and the supposition is not nonsense, at least

[1] *Kritik der reinen Vernunft*, 1ste Auf., p. 494.
[2] *Op. cit.*, p. 251.

there cannot be bare subjects lying in wait for objects, nor objects that by definition never are positively objects. If the categories of substance and cause are only valid *within* experience, they cannot be applied to experience as a whole. Whatever implications experience may involve, it surely cannot involve that of transcending itself. Such miscalled transcendence, if it have any validity, must really be immanence at bottom.

If this duality in unity of subject and object be indeed the fundamental fact of experience, implied alike in cognition, in feeling, and in volition, then, so far at any rate, there can be nothing to explain. The demand for explanation may be taken as evidence that we have misconceived the facts. On this ground therefore we must suspect and avoid all statements of experience that introduce conceptions of relations narrower and more special than itself. Such, for example, is the reference to organs of sense excited by external stimuli. Such again is the contrast of perceptual experience with experience as modified by intersubjective intercourse, a contrast which leads us first to picture each individual as confined strictly to his own inside, and then with Mr. Spencer and others to exclaim about "the mysteriousness of the consciousness of something that is yet out of consciousness, which, nevertheless," they say, "we are obliged to think."[1] I am well aware that this is the region of controversy and that dogmatism is here peculiarly unbecoming. But there is another side to the situation. The very failures that have overtaken the old watchwords make it fitting to ask, whether it

[1] Cf. Spencer, *Principles of Psychology*, vol. ii, p. 452.

be not possible to take a little less for granted, and to be charier of metaphors; whether it is not time to treat as futile all attempts to *explain* experience, at any rate all attempts to explain it by what falls short of it on the one hand, or goes beyond it on the other. To enounce that experience is a whole, or more precisely a continuity, that it consists in the correlation of subject and object as its universal factors, is a statement that seems to tamper with no facts and to involve no hypotheses.

We must now look closer and see if this conception of its unity still holds good when we come to details, and advance from simpler to more complex forms of experience. The first thing to note is that experience in the concrete, that is any one's experience, is a process, not a product. We speak of certain fixed arrangements of objects as a product — a house, for example, or a proposition of Euclid. But on the other hand all products, whether of thought or art or nature, presuppose processes, of which we either have, or conceive that we might have, an experience. We cannot, of course, recall the beginning of our own experience, nor can we, either by observation or inference, attain to any conception of an experience which should be the simplest possible. But all that we know, directly or indirectly, warrants the statement that all experience is process; not merely change, not merely 'felt change,' but felt interchange. Broadly speaking, every objective change, every change of perception, entails a subjective change; and every subjective change an objective change. I say, broadly speaking, because there are *uninter-*

esting presentations, to which there is no subjective reaction, and which are *pro tanto* of no account even for knowledge. In other respects, nevertheless, these deserve our consideration; they shew that the objective continuum has no definite limits, and they constitute a field for future advance. Such a beyond we are never without. To this topic belongs Leibniz's classic distinction between perception and apperception, the conscious and the subconscious, with all the tangled questions thereto appertaining. To these we may have to recur later. But we may for the present leave all this aside.

The selective interest, which we may fairly take as characteristic in some measure of all experience, leads to the remark that experience as a process may be further defined as a process of self-conservation, and so far justifies us in describing it as life, or *βίος*. It is scarcely an exaggeration to say that the objects of experience are not primarily objects of knowledge, but objects of conation, *i.e.* of appetite and aversion. For though an object must be cognised before it can be liked or disliked, still it is to interesting objects that the subject mainly attends, and it is with these, therefore, that the subject acquires a closer and preciser acquaintance. A certain affinity or *consensus* between this feeling and acting subject and its objective *continuum* is then characteristic of actual experience, so far as we can ascertain. Such intimacy and adaptation is simply the counterpart of the fact that to each subject there pertains a distinct organism and a special environment. It was but a one-sided analysis, logical rather than psychological, that led Kant

to resolve experience into the dualism of matter and form. Oddly enough Kant illustrates his position by referring to the embryological controversies of his time, but yet fails to see how close is the connexion between experience and life. There were three hypotheses concerning life then in vogue: first, that of its spontaneous generation from matter; next, the hypothesis that all life begins from a germ. But of this there were two varieties, the pre-formation hypothesis, according to which the germ was literally a complete organism in miniature, which merely unfolded like a bud; and the hypothesis of epigenesis, which denied this mere expansion of the germ, and maintained that each organism was built up *de novo* by a formative impulse or *nisus*. With this last hypothesis, which was the best established, Kant compares his own theory of experience; to the first he likens the sensationalist theory as commonly put down to Locke; while Leibniz's preëstablished harmony is apparently meant to correspond to the second. It is, no doubt, as hopeless to try to conceive experience arising simply out of any mere aggregate of sense-impressions as it is to conceive life emerging from any aggregate of material particles. But is the case really mended when over against such an aggregate of sense-impressions we set the pure reason of the Kantian philosophy with its forms of intuition and of thought? From pure matter to which all form is indifferent, and pure forms to which all matter is indifferent, how is a definite result possible? The *nisus vitalis* in the hypothesis of epigenesis was, after all, only formative within an already organised germ, and

was powerless to act directly on unformed matter. If Kant is to be in earnest with his simile of epigenesis, then he must discard the formless matter of his sense-manifold. As I have already urged, psychology has certainly disposed of it, and we may safely say with Professor Stumpf, to whom this question owes so much, that "that cannot be true in epistemology which is false in psychology."[1] Whatever may be the value in logical analysis of the metaphor of matter and form, "the clumsy potter's phrase," as Herder styled it, it is certainly inadequate to the synthesis of experience, as indeed all material analogies are.

Kant represents this synthesis of experience as an activity of the subject, an activity too which in thought is spontaneous. But the point upon which I am concerned to insist is that there is no activity and no spontaneity apart altogether from feeling and interest. Experience can *not* without mutilation be resolved into three departments, one cognitive or theoretical, one emotional, and one practical. To be just to it, Kant's three critiques must be combined into one. It is true that what we take and what we find we must take and find as it is given. But, on the other hand, it is also true that we do not take — at least do not take up — what is uninteresting; nor do we find unless we seek, nor seek unless we desire. The cognitive aspect of experience, in a word, is far more one of experiment, as its very etymology suggests, than one of mere disinterested observation. The philosopher may look on at the buyers and sellers in the market-place, but the real

[1] *Psychologie und Erkenntnisstheorie*, 1891, p. 18.

experience is their trafficking, not the notes of this detached bystander. Regarding experience in this wise as life, self-conservation, self-realisation, and taking conation not cognition as its central feature, we must conclude that it is not that 'content' of objects, which the subject cannot alter, that gives them their place in its experience, but their worth positive or negative, their goodness or badness as ends or means to life. We realise this truth if we try to imagine a purely cognitive being — a subject apprehending or thinking but devoid of any interest in thought or apprehension. What psychologists call 'the span of consciousness,' its limited field and still more limited focus, has to be taken into account. What is to determine which objects shall enter this field, and on which attention shall be concentrated?[1] Kant, no doubt, did well in declaring the synthetic unity of apperception to be the paramount principle of knowledge, but it is surely a mistake to suppose any synthesis, or any unity, possible, apart from motives to action and a practical interest in things. The centrality and organization — I intend the words to be taken very literally — which all concrete experience manifests, could never arise to a merely cognitive subject; nor to us, if our intellective were independent of our practical powers. In proof of this we have only to turn again to what Naturalism takes as the basis of experience, viz., an indefinite multiplicity of inert unchangeable items related only by unchangeable, unmeaning, mechanical laws. From such a centreless, aimless,

[1] We can scarcely credit such a subject with an organism, for this seems necessarily to imply sentient activity.

fatalistic scheme, "a cosmic process that has no sort of relation to moral ends,"[1] to reach experience as the self-conservative process which it is for each of us, is impossible. It is this inability which we are seeking to overcome.

Even spatial and temporal relations as we actually experience them involve practical elements, which can only be accounted for when experience is regarded as life and not merely as theory. For lack of these elements the mathematical conceptions of space and time are abstract and unreal. Kant, as we all know, treats both space and time as pure forms of intuition; and space and time as conceptual ideals *can* be so treated. But I think psychology teaches us that we should have had no perception of either the one or the other but for our practical interests. One essential of spatial perception is voluntary movement.* Though such movements are objective changes as much as sensations are; yet they are changes which produce other objective changes, and changes which the subject initiates. To them we owe the notions of distance and of measurement. To them we owe, too, the all-important notion of a definite origin, a here to which we relate all theres. Similar remarks apply in the case of time. The present is the time in which we act; the future that for which we prepare. To the present we actively adjust — we look, listen, handle, pursue, retreat. With the past, as past, we have no dealings; it is "over and done with" as we expressively say, save as it leads us to expect and modify the future.

[1] Huxley, *Evolution and Ethics*, p. 34; *Collected Essays*, vol. ix, p. 83.

* See Note i, p. 607.

It will repay us to reflect on these points a little longer, as a comparison of our concrete time and space perceptions, if I may so call them, with the abstract ideals of time and space current in exact science helps to lay bare the shortcomings of dualism. We shall find a far more intimate connexion between the subjective and objective factors of experience than would be possible if dualism were true.

If the psychological doctrine that the perception of space implies active movement be sound, then no merely cognitive activity in apprehending and comparing changes of quality and intensity would make us aware of space as an indefinite manifold of three or more dimensions. We might still have our objective continuum; and the changes in this, like the changes in a melody or in our organic sensations, might — we will for the present suppose — be remembered and compared. Time as the abstract form of succession would thus be possible. But the only element of space that we should have would be that of extensity: the voluminousness or massiveness that we now connect with embodiment we should not then connect with anything definite, for there would then be nothing from which to distinguish it. Whether, on shipboard, we look down at the deck, or away to the horizon, or upwards at the sky above us, the extensity of the colour sensation is in each case the same; the difference in the space seen is due to acquired perceptions involving movement.[1]

[1] A fact first clearly brought out by Berkeley in his *Essay towards a New Theory of Vision*, thus opening a new chapter in the theory of knowledge, and one the full significance of which has hardly yet been realised.

"We can never imagine," says Kant, "that there is no space, although we can quite well think that no objects are *met with*[1] in it." But, having thought away all objects, how do we imagine this empty space itself? Kant's own words betray him: we suppose ourselves to be traversing this space and *meeting* with nothing as we proceed. But how could such a progress be imagined by a subject incapable of active movement; and if there were no such imaginary movement what would be left of pure space as an infinite whole? And again, though in the first part of his *Critique* Kant describes space as an infinite given magnitude, in the next he has to allow that we cannot think of a line without in thought *drawing* it, or of a circle without *describing* it, nor ever imagine the three dimensions of space without *producing* three lines intersecting each other at right angles through the same point — all which is obviously in contradiction with the notion of space as an infinite given whole.

Perhaps we may most clearly realise that movement is an essential element in our spatial experience if we contrast with it that omnipresence or 'repletive ubiety' as the schoolmen called it, which they — followed by Locke, Newton, and Clarke — attributed to the Deity.[2] In a remarkable passage in his *Opticks*, Newton speaks of absolute space as the sensorium of God; and Clarke in his famous controversy with Leibniz[3] compares the

[1] Italics mine.

[2] Of course it is empirical space not the abstract space of geometers with which we are now concerned. Kant's great mistake was to confound the two.

[3] Leibnittii *Opera Philosophica Omnia*, ed. J. E. Erdmann, p. 750.

presence of the soul to the sensations "in its little sphere" with this living presence of the Deity throughout immensity. The ubiquity of the soul in the body as sentient—'definitive ubiety,' as the schoolmen termed it—is thus the counterpart of the omnipresence of God in space; or, according to the phraseology I have been using, a presentational continuum of infinite extensity is present to the Divine Mind, but to the creature mind a continuum limited to the impressions of a definite organism. With the alleged defects of Newton's simile—as, for instance, that it makes God the soul of the world—we have at present no concern. It serves to bring out one point: the only experience in which an intuition of space as an infinite given whole is possible, is one in which every place is here and all places present together. To such ubiquity movement would be needless and even unmeaning; but such ubiquity would not be our space. Within the little sphere of its own sensorium, to use again Clarke's phrase, the finite subject has ubiquity, but unlike the Deity, it can actively intervene even here only by movements. Apart from these this restricted ubiquity would not suffice for a 'form of externality.' But it is our conative interests that lead to these movements by which we advance to the full perception of space.

It belongs to psychology to explain this advance in detail: the distinction of the body as an occupied space in which impressions are 'localised' from other bodies and the environing space into which impressions are 'projected'; the invariable reference to the body as the here or point of departure; the steadily decreasing defi-

niteness of these spatial perceptions as the radius of the little sphere extends, and we pass from the more adjacent places, in which we can discern both direction and distance, to those in which only directions are perceptible, from places so contiguous as to be controlled by changes of posture to those amenable to control only by locomotion. It is from this psychological, perspective space, with its absolute origin in the 'here' of the percipient, each successive shell, as we recede from this centre, differing in characteristics and ordinates and even dimensions, and differing largely by reason of the different movements to which it is correlated — from this concrete spatial scheme it is, I say, that the abstract space of Euclid has been elaborated. And it bears manifest traces of its origin, as the recent developments of generalised geometries abundantly shew.[1] I grant that geometry involves intuitive construction and not merely logical distinction; but this construction presupposes such free movements as our bodies can make, movements either of translation or of rotation. Had we been "evolved" to maintain like compass-magnets one constant orientation, or like screws to move only by rotation and translation conjoined, it would be hard to say what we should have made out of space of three dimensions.

But, though our geometrical space contains elements due to our motor experiences, it differs in important particulars from our spatial perceptions. *Entre l'homme et le monde il faut l'humanité*, said Comte; and it is precisely this intervention of 'humanity,' of *Bewusstsein*

[1] Even the phrase the '*third* dimension' for depth is in this way significant.

überhaupt, as Kant styled it, of understanding, reason, thought — call it what you will — *between* the percipient and his immediate objective experience that has made geometry possible; and it is this also that has given rise to dualism. We shall have to deal with this problem at length in the next two lectures; but it may be helpful to anticipate that general discussion so far as space and time are concerned. An adequate treatment even of this special question is quite beyond our limits. I propose to refer to only three closely related topics in this transition from spatial perception to spatial conception, the transition, in other words, from actual experience of spatial relations to the bare idea of pure space. Into the actual experience there enter always three factors; viz. various extensive continua, various series of active movements or motor continua, and a primary position or origin, which we call 'here.' About all these there is — from the standpoint of individual experience — something absolute. Sensory impressions as extensive, movements as protensive, have what psychologists call 'threshold values.' Such *minima sensibilia* furnish a standard of magnitude that is indeed relative *to* the individual, but not relative *for* the individual. A man cannot take thirty steps to the yard as a mouse must do, nor can he 'mark time' like the wings of a gnat. I have always admired the sagacity of Locke's remarks on this point: "Every part of duration," he says, "is duration too; and every part of extension is extension, both of them capable of addition or division *in infinitum*. But," he adds with emphasis, "*the least portions of either of them, whereof we have clear and*

distinct ideas, may perhaps be fittest to be considered by us, as the simple ideas of that kind, out of which our complex modes of space, extension, and duration are made up, and into which they can again be distinctly resolved." He then proposes to call this perceptual element of space "a *sensible point*, meaning thereby the least particle of matter or space we can discern."[1] What is epistemologically important in this passage is that it denies thoroughgoing relativity of our spatial (and temporal) perception, while allowing such thoroughgoing relativity to belong to our conceptions of space (and time). Given only the pure space of Kant and the geometers, it is impossible to 'deduce' the actual space of experience; but, given this, the deduction of that is intelligible. The one, as perceptual, really affords a foothold for the construction of the other as a conceptual ideal. Psychologically regarded, 'large' and 'small' are not purely relative terms; while, *per contra*, zero and infinity are simply negations. Certain inconsistencies in Kant's doctrines will make this clearer. First, Kant tells us space is a form of intuition; but a *form* of intuition is not itself an intuition, any more than a blank cheque is a sum of money. How then, we ask, do we obtain intuitions of definite pure spaces? To this question Kant gives two diametrically opposite answers. On the one hand he tells us that space ought not to be called a *Compositum*, but a *Totum*,[2] because the parts are only possible in the whole, and not the whole through the parts. In conformity with this standpoint, he then

[1] *Essay concerning Human Understanding*, bk. ii, chap. xv, § 9.
[2] *Kritik der reinen Vernunft*, 1ste Auf., p. 438.

describes definite spaces as arising solely through the limitation of this infinite given whole. But on the other hand he also asserts that space is not a *totum*, but a *compositum ideale*, "in which the idea of the part makes the idea of the whole possible, and therefore necessarily precedes it."[1] It is in keeping with this that he says:[2] "I cannot imagine any line, however small it be, without in thought drawing it, *i.e.*, from one point producing all the parts, one after the other." But how, I ask, is either procedure possible? How, setting out from space as an infinite whole, am I to determine the point by limitation, and how, from the point as zero, am I, by a gradual synthesis of smallest possibles, to set up the infinite whole? But there is still a third view of space to be found in Kant's writings, and this is, I think, the true one. The infinite extent and the infinite divisibility of space are ideals; setting out from a finite line, we can actually progress or regress indefinitely, but not infinitely. Pure or absolute space is then not the presupposition of spatial experience, but the consequence of idealising this. In keeping with such a doctrine, we can say space is both a *totum* and a *compositum*—a *totum* so far as our "little sphere" of extensity or ubiquity goes, a *compositum* so far as we quantitatively differentiate and extend it by movements. This is the foothold to which I just now referred, from which we proceed to measure the world. Active experience thus becomes the basis of geometry, not geometry of experience.

I pass now to my second point. The place we call 'here,' however relative to the individual, is absolute

[1] *Op. cit.*, 2te Auf., *Analytik*, § 26 *n.* [2] *Op. cit.*, 1ste Auf., p. 162.

for the individual; 'here' is where we primarily distinguish right and left, up and down, before and behind; here is the point through which we set up our rectangular coördinates and distinguish what Kant called regions in space. But suppose we start with pure space, where is this origin to be placed, and how are these axes to be laid out? Anywhere it will be said, and anyhow, provided the axes are rectangular. Very good, but then why not everywhere and everyhow and differently at different times? The quandary of the famous ass of Buridanus is as nothing to this and no Leibniz can come to the rescue with the principle of indiscernibles. There is no here and no there, no east, no west in pure space. Its thoroughgoing relativity constitutes it an absolute; it is absolutely relative, — a system of relations without a *fundamentum relationis*, and so a non-entity. The form of a human hand, if we imagine it as the first thing created, would certainly, as Kant says, be that of a right hand or that of a left. Every actual figure must be a definite figure. But I cannot see that such a hand would furnish any evidence of the distinction of regions in absolute space; or even that it would do so if its counterpart were placed beside it. A right and left hand alone in space do not suffice to constitute right and left regions there. Referred both to the same direction, as they perfectly well might be, they would suggest not symmetry but dissimilarity; and, in fact, while to the harp-player they present the one character, to the pianist they present the other. The 'here' of actual experience is the first position in space; to this all other positions experienced are relative, as positions

in the environment. It is from orientation in such a space, a space largely projective, the space, in short, of visual perspective, that we slowly advance, aided by our own memory of the past and by intercourse with others, to the geometrical conception of space as an extensive continuum of three dimensions, homogeneous in all respects. But setting out from such an abstract conception, simplified to the utmost by long experience, we should find it hard to attain to the concrete space in which we live and find our bearings.

And how do we find our bearings? This brings us to the last point I will venture to notice, — the nature of empty space in which we should certainly find none. Common thought and science alike regard space as a receptaculum, which as such can be either full or empty, and is, in fact, partly the one and partly the other; so at least Newton conceived it. I will say nothing of the glaring logical circle involved in thus describing space by a figure of speech which presupposes it. What I wish to challenge is the notion that space is in *any sense* prior to or independent of the empirical objects that are said to occupy portions of it and to be all contained in it. It is certain that our first experience is not of "extension which is extension of nothing at all,"[1] but of bodies that are extended. Nor can it be maintained that since the perception of body as extended requires movement, and movement implies space to move in, therefore the knowledge of occupied space implies the knowledge of empty space as well. There is no warrant for the assumption that movement

[1] Croom Robertson, *Mind*, vol. xiii, p. 422.

is impossible without a vacuum, as Locke supposed. Such a view takes for granted that bodies consist ultimately of adamantine particles, incapable of either dilation or compression. This, as Kant, I think, has conclusively shewn, is "a purely metaphysical hypothesis."[1] More in keeping with immediate experience, to say the least, is the view that occupation of space is not a mechanical but a dynamical occupation, and one admitting therefore of varying degrees of intensity. Whether nature abhors a vacuum or no, we at any rate have no evidence of one. Movement is possible where displacement is possible, as we see in a globe of fish, and no other condition is necessary. But, though empirical space is never empty space, the fact that bodies retain their forms and yet freely change their places enables us, first to separate the conception of a given space from any particular body, and then to advance to the conception of space as a whole devoid of all real content and occupied only by itself. We do not say there is nothing there, but that only space is there. And had the empirical space, from which we derive this conception, been one in which we had never found any bodies possessing either fixity of form or fixity of position, our conception of pure space, if we ever attained to it, might have been one in which all the parts were movable, though the motions could no longer be distinguished. As it is, we have derived our notions of space from relatively rigid bodies and relatively fixed positions, and accordingly we conceive the parts of pure space as immovable, though these parts can no

[1] *Kritik der reinen Vernunft*, 1ste Auf., p. 173.

longer be distinguished. It is odd to note here how extremes meet. What would be true of a space filled with adamant we predicate of a space filled only by imagining it empty. But let us not forget two things: (1) this pure, absolute, immovable space is an ideal; (2) such a conception is only possible to subjects that have had full experience of extended bodies and their relative places and displacements. In a word, the space of the geometers is neither *a priori*, pertaining wholly to the subject in Kant's sense, nor real apart from objects of experience in the sense of Newton and Clarke. It is indeed the work of the mind, has ideality and validity, but not reality; but also it is based upon concrete experiences, in which both subjective and objective factors coöperate.*

In the case of time the same general considerations again present themselves, leading, as I think, to the same conclusion. It will suffice to refer to these very briefly. The scientific conception of time as the great independent variable, is only attained by way of temporal perceptions, involving active elements that in turn depend on subjective interests. A mere series of 'nows' would give us no knowledge of time; indeed it is proverbial that so long as we are absorbed in the present we are oblivious of time. "*Dem glücklichen*," said the poet, "*schlägt keine Stunde.*"[1] It is the impulses and interests that the present does not satisfy that bring the fact of time before us; it is appetition that leads us to await; and the tension of pursuit gradually nearing its prize that marks the succession and measures the length

[1] Schiller, quoted by Volkmann.

* See Note ii, p. 608.

of time. The more carefully psychologists reflect upon the facts of life the more clearly, as it seems to me, they should see that such processes as retentiveness and association, however indispensable, are of themselves insufficient to account for either memory or expectation. Only through subjective selection with its consequent restriction, differentiation, and emphasis of special presentations, can temporal order become distinct. For in such restriction and emphasis we have what the psychologist calls a focus of consciousness; and it is by their successive occupation of this focus that perceptions obtain definite time-marks.

But there is more in temporal experience than succession; there is simultaneity and duration as well. We have all these together in change; and change, we may safely say, is the fundamental objective fact in all our time experience. We cannot perceive a change as happening, unless two or more of its continuous phases are perceptibly distinguishable within the limits of what is for us an enduring now. If no difference of phase is discernible within this 'specious present' as it has been called — whether because the succession is too rapid or too slow, or the difference too slight, matters not — in such a case, though there be a change, we shall perceive none. With time as with space, infinite divisibility is not a matter of concrete experience; we have a certain natural *tempo*, which, however relative when referred to pure time, is not relative for us. In temporal perception too, as in spatial, we have a certain limited ubiquity, a *nunc stans* or enduring now, within which attention moves. Such a movement or 'moment,'

"the time of only one idea in our minds" as Locke said, is not positively resolvable into a succession; and conversely such moments could not themselves constitute an actually experienced succession, if there were no enduring present within which two or more of them could fall. We are not called upon, I think, to inquire further into the psychological characteristics of this duration. What concerns us rather is the fact that this perceptual experience has no counterpart in the scientific conception of time. There every duration resolves into succession and there is no *nunc stans;* the present is a point of time, not a portion of it. Even this is saying too much; for as in empty space we have no ground for distinguishing here from there, so in empty time we have none for distinguishing now from then; and even the oneness of direction, from past to present, from present to future, is merged in oneness of dimension. It is easy to understand how the collective experience of the race has elaborated this abstract ideal of empty time; but it is surely a mistake to regard it, either as a form of intuition presupposed in all temporal experience, or as having any kind of reality apart from the events which are figuratively said to fill it. It is only as we approach it from the side of these that we can give any meaning to such a notion at all. In this respect it is much on a par with indeterminate forms,—such as $^0/_0$, $^\infty/_\infty$, etc.,—which can only be interpreted when it is known how they have been reached. An experience is quite conceivable, in which there would have been no opportunity for the observation of natural, or for the invention of artificial, time-measurers. In

such a case, I imagine, our quantitative conceptions of time would have been as faulty, or as complex, as our spatial conceptions in the absence of all experience of rigid bodies. But whether flowing evenly or not, time cannot be conceived as flowing at all unless we take account both of duration and simultaneity. True, succession alone can be brought under the mathematical rubric of dimension, but the practice of representing this one dimension by a line, at once reveals the other elements lurking under it. For we do not literally identify time with a line, but by the length of the line we measure duration, and by motion along it we conceive succession. But we must have a finite portion of the line presented as coexistent, and we must have two positions of the moving point apprehended together and yet distinguished as successively occupied, before we can conceive time: all which we find in every concrete experience of change.

And now, in conclusion, I must endeavour to indicate the bearings of this discussion on our main problem,— the refutation of dualism. Time and space, I have contended, belong neither to the subject alone apart from the object, nor to the object alone apart from the subject, but to experience as the duality of both. They are neither subjective forms psychologically or logically prior to experience, nor are they objective realities independent of experience. Before it is possible for us to elaborate those conceptions of pure, empty, absolute space and time, of which geometry and its possible pendant, chronometry, treat, we must first experience spatial and temporal relations in the concrete. To these

the child and the brute are confined: our advance beyond them is due to that partial transcendence of individual experience which intersubjective intercourse secures. It is this transcendence of any given perceptual experience which misleads us into regarding the space and time of mathematics as independent of experience altogether — a fundamental delusion of the dualist to which we shall have to refer again and again. Into our concrete experience of spatial and temporal determinations there enter elements due not merely to the cognitive activity of the percipient, — if we allow for a moment that such activity is conceivable alone, — but elements due to the conative and practical impulses and interests of the subject as a living and self-conserving unity. If this be true, then obviously the procedure of Naturalism must be wrong; experience cannot be disarticulated into dual worlds, one of phenomena and one of epiphenomena; nor the latter be regarded as secondary and dependent on the first as the only world that is capable of going along of itself. The notion of empty space and time as necessary antecedent conditions, either in thought or fact, of the things and events that are said to fill them, although a very natural and persistent inversion of the truth, has — as I think — been conclusively shewn to *be* an inversion, both by psychologists and epistemologists too of widely different schools. But my old teacher, Lotze, has perhaps done most to give this conclusion sterling currency in the philosophic world. It seems fitting then to bring this lecture to a close with some words of his concerning time. "Only in the content itself of what-

ever happens, not in a form at hand outside it, into which it may fall, can the ground lie both of the order of its succession and of its being a succession at all. . . . Becoming and activity come first, and bring forth from themselves either the actual course of time or the appearance thereof in us. The persistent contradiction which imagination would allege against such an inversion of our usual mode of thought, we can as little get rid of as of our habit of saying that the sun rises and sets; but we may hope to understand the one illusion as well as we understand the other."[1] Unhappily, I may add, science holds as inveterately, but with far more self-confidence, to the one illusion as common language does to the other.

[1] *Metaphysics*, § 148.

LECTURE XVI

RISE OF DUALISM

Two forms of experience have emerged in the course of our previous discussion: the experience of a given individual and Experience as the result of intersubjective intercourse. Dualism maintained by misconception as to the relation of these two, and by their separate treatment—the one exclusively by psychology, the other by the natural sciences. To refute dualism, then, we need to show that the second form of experience is an extension of the first and that there is organic unity throughout both.

In the case of individual experience, this organic unity illustrated by reference to (1) *Range in time,* (2) *Familiarity or Expertness, and* (3) *Intellective Synthesis.*

Intersubjective intercourse leads to universal Experience, and gives rise to the naïve dualism of common thought. It does this through (1) *the notion of the transsubjective* (*naïve realism*), *and* (2) *the hypothesis of 'introjection'* (*animism*). *A protest against the phrase 'internal and external experience.'*

THE discussions that have largely occupied us during the last two lectures have, I trust, brought out three points. First, we found experience used in a double sense: there is the experience, the living experience, of a given individual, filled with concrete events and shaped from first to last by the paramount end of self-conservation and self-realisation. There is also experience generally—Experience with a capital E, the common empirical knowledge of the race, the result entirely of

intersubjective intercourse, systematised and formulated by means of abstract conceptions. Next, we found grounds for suspecting that dualism has arisen from misconception and ignorance as to the relation of these two senses of experience. Experience in the first sense being relegated to psychology, experience in the second remained as the sole business of natural science; and the one experience coming then to be regarded as exclusively subjective and the other as altogether objective, a clear line emerges between the two and the dualism of Mind and Nature is the result. But now, in the third place, we have found that our primary, concrete experience invariably implies *both* subjective and objective factors, and seems to involve these, not as separable and independent elements, but as organically coöperant members of one whole. If they bear this character throughout, then logical distinction of these factors is possible but not their actual dismemberment; there is duality but no dualism. Thus to refute the dualism of ordinary scientific thought, it is necessary to shew that the generalised or universal Experience with which it is immediately concerned has grown out of, depends upon, and is really but an extension of, our primary, individual, concrete experience; and to shew also that within experience there is always organic unity. I have tried already to prove both to be true in the particular case of space and time; arguing first, that spatial and temporal perceptions involve both subjective *and* objective factors, are not purely subjective in the sense of being wholly *a priori*, nor purely objective in the sense of presenting independent realities; and arguing further, that

the conceptions of space and time scientifically in vogue are idealised derivatives of these perceptions. We might proceed to argue in like manner concerning matter and force. But our earlier discussions of the mechanical theory have, I trust, sufficiently forestalled such detailed inquiry in these cases. In fact, we found half our work done for us when we attended only to the teaching of those physicists who have any claim to philosophical competence. They admit that the matter and force of which they treat are not in themselves perceptual realities, are not phenomena, but abstract ideal conceptions devised for the description of such. Perceptual realities at all events belong entirely to individual experiences; and descriptive conceptions plainly imply intersubjective intercourse; in other words, universal, or, as it has been called, transsubjective experience. Inasmuch, then, as we suspect the dualism of mind and matter to be grounded on the absence of clear knowledge concerning the relations of these two forms or phases of experience, it will help us most to continue our inquiry on broader lines and to omit meanwhile further detailed discussion of conceptions such as matter and force.

But first of all a *caveat* must again be entered against such terms as percepts, perceptual reality, and the like, which as the only terms in general use we have not been able altogether to avoid. The assailant of dualism is at a unique disadvantage; the very weapons he uses have been forged by the enemy, and seem designed to betray him. Our psychological terminology is perhaps the most treacherous of all. What each one immediately deals with in experience is objective reality in the most fun-

damental sense. But first it was styled a picture or impression; probably because on the retina of the percipient an optical image of the things he looks at can be seen by another. Then, when the progress of science shewed that our so-called sensory impressions cannot be literally representations, or copies, they lapsed into vicarious representations, or symbols, of the objects of universal experience. Finally came the vexed question: How does the individual or how do any number of individuals, all confined to vicarious symbols, attain to an acquaintance with the real originals assumed to lie beyond? Thought, foiled in its attempts to advance, was led to retrace its steps. At this juncture the protest of Reid occurs and, despite his faulty reconstruction, the protest in itself was sound and weighty. Of this, the revival by so many thinkers in our own day of Reid's problem is a striking proof. Two things seem certain: Experience in which conceptions figure is preceded by experience in which they do not; and in this earlier experience the distinction of percept and object does not arise. Perceptual reality is then for us only a convenient term to distinguish the present objects of the one experience from the objects of the other. What each one immediately deals with in his own experience is, I repeat, objective reality in the most fundamental sense, and we have to be incessantly on our guard lest the psychological terms we naturally use mislead us unawares.

With this caution we may now resume our inquiry. Before the stage at which experience is extended by intersubjective intercourse, can it be dismembered into two independent wholes? It may suffice to select for

consideration three distinct but related characteristics of developing experience. We may call them (1) Range in time; (2) Familiarity or expertness: (3) Intellective Synthesis. The first of these has been already to some extent anticipated in our previous discussion of time. Inasmuch as experience is always experience of process or change, an experience confined strictly to each present instant would be as much a contradiction as an experience ranging indefinitely through an empty time in which nothing happened. In one or other of these meeting extremes the matter of the physicist is placed; neither as actual subject nor as concrete object is it conceivable. Not as subject, for as inert it initiates nothing and is indifferent to everything; of its varying external circumstances it retains no trace. Not as object, because in *itself* it is unchangeable and its external changes have severally succession but no duration. Some such considerations as these were present to Leibniz when in his early essay on Abstract Motion he said, *omne enim corpus est mens momentanea.*[1] The conception of body suggests the extreme limits between which experience proper lies. In order to such experience at all there must be an enduring present; and in order to its fuller development there must be some retentiveness or memory of the past.

It has always been a difficult problem for psychology —this hold on the past secured by memory; and few are the psychologists who have realised what a fundamental fact it is. Far too commonly it is imagined that memory is mainly a matter of retentiveness; accord-

[1] *Philosophische Schriften*, Gerhardt's ed., iv, p. 230.

ingly when an array of physical instances of such retentiveness can be marshalled, the mystery of memory is thought to be fairly cleared up. But we could never find a single such instance save with the help of memory, nor would they be reliable even as physical facts except on the assumption that memory is trustworthy. Nay, the bare term 'retention' itself, and all cognate terms, such as 'trace' or 'residuum,' are meaningless unless some present circumstance can be related to the past; thus they presuppose memory. The analogy of inscribed records is a favourite resort of those who strive to elucidate the nature of memory by physical imagery; we find it again and again in Locke, for example. Such an analogy is about on a par with that between the eye and a telescope — the one is a natural, the other an artificial, organ or instrument of vision; but neither will explain seeing as a psychological fact. Brain traces and written records are in the same case. Such phenomena as those of resonance, phosphorescence, hysteresis, and the like, often cited in support of the childish absurdity of 'ideagenous molecules,'[1] will carry us about as far in the explanation of memory as writing materials will in the explanation of memoranda; the writer himself and what he is interested to retain are still lacking — that is all! But these are the essentials, the efficient cause and the final cause of the result. Physical analogies are here, as usual, worthless to the true psychologist, and throw no light on memory-knowledge. Recourse to them is a consequence of dualism and their ineptness so far a refutation of it. Apart

[1] Cf. Huxley, *Collected Essays*, vol. i, p. 239.

from the activity and interest of the subject there is no evidence of retentiveness, whatever be the physical intensity of the stimulus or however frequent its repetition. Nor is the so-called 'retention' in the least comparable to the unchanged persistence of an effect, or to the preservation of goods in a storehouse safe from the teeth of time. On the contrary, we only retain what we change, in other words, what we assimilate. If the old merely persisted, we should have an accumulation as fruitless as a miser's store. Or if the past merely recurred again unchanged, it would be indistinguishable from what is simply present; to be known as past, it must bear the marks of the past about it, marks which it obviously could not have had when first present. These dates, or temporal signs as they may be called, plainly bespeak that unity and solidarity of individual experience which only subjective activity and interest can bring about. What is thus dated or remembered is our own past experience; we can *remember* nothing else. In this way there arises at once our subjective or biotic time along with its concrete 'filling,' both inseparable from the individual subject to which as its own objective experience they immediately pertain. It is from this that we advance to the mediate conceptions, first of transsubjective or common time, and finally, of absolute time. Again it is from the immediately presented content of this subjective time — what each one calls 'my time' — that we proceed to range events chronologically in the common historical time, which we come to think of in dualistic fashion as independent of all subjective factors.

Here, again, then we have to expose the covert dualism that renders our psychological terminology unsuited to epistemological discussions. As we are supposed to know present objects through impressions of them, so are we said to know the past through memory-images; the process is held to be alike mediate and vicarious in both cases. On the contrary, I venture to maintain that it is equally immediate in both. The distinction of memory-image and past object only arises at the level of universal experience, when dualism first becomes possible. On the question of fact Reid seems to me to have been here also in the right and far more consistent than his more learned exponent, Hamilton, who at this point forsakes him.[1] In particular cases memory may be fallible, as in particular cases the senses may be illusory; but there is no appeal in such cases which does not rest on their general validity. So far the mediate knowledge of universal experience presupposes the immediate knowledge of individual experience. If we could never trust memory implicitly, it would be impossible ever to test it. But how could we ever trust memory implicitly if all memory-knowledge is mediate, — how could we ever know lapse of time at all if we never know it directly? It is only our extreme familiarity with the universal standpoint which hides from us the necessary priority of individual experience, a priority which nevertheless seems obvious on reflexion. So far then we find the duality of subject and object in the unity of experience will not resolve into an independent dualism of internal world and external world. I pass now to the second point.

[1] Cf. Reid's *Works*, Hamilton's edition, p. 339, and Ap. *B*, p. 813.

Experience and familiarity, experience and expertness, are closely akin, so closely that we cannot, I think, call that experience in which there is nothing of either. To begin the exposition of experience from the standpoint of Locke's *tabula rasa*, or from that of Kant's chaotic 'manifold,' is in reality to attempt to shew how experience arises from what is not yet experience. We can discuss digestion beginning from an empty stomach but not from an empty plate, and we can continue with a stomach filled from a larder but not with one filled from a chemist's cupboards. In a word, as I urged in the last lecture, an epigenesis of experience is possible but not an abiogenesis or *generatio æquivoca*. In any actual experience the sensory presentations are not wholly strange nor the motor responses entirely inept. As in this wise experience is from the first an organic unity, so it continues in its development, when more and more things are known, and more and more things can be done.

But this advance, as regards knowledge at any rate, depends primarily, it may be said, on the repetition of like circumstances, that is, on 'the uniformity of Nature'; and this again, it may be urged, is a cardinal fact independent of all percipients. Such a view is, no doubt, part and parcel of the dualism we are seeking to refute, and will occupy us further by and by. Meanwhile, as regards individual experience, it is obvious that whatever objective uniformity there might be, it would remain unknown or meaningless save to a subject itself characterised by continuity and uniformity. After all, though we talk of uniformity of *nature*, as of some-

thing independent of us, yet it is uniformity of *experience* that we mean. It is not only idle to make suppositions about things *per se*, but indifferent what suppositions we make. Even though there were no assignable limits to the diversities existing in the absolute elements of such things and in their ultimate relations, yet a subject that could combine and select might still find its experience continuous and uniform. For, in the first place, — as I just now urged, — we can never shew how experience arises, cannot carry back our analysis till we reach a dualism of subjects *per se* and objects *per se;* and, in the second, all our assertions of identity among reals are at bottom negative, amount simply to saying that we discern no difference. Even in such a world there could be events which, though diverse in themselves, were alike in being helpful; and others, also otherwise diverse, alike in being harmful, to a given subject; whilst others were entirely neutral. Such a subject then, — possessing some measure of that selective power which in earlier lectures we have found to belong to all things living, — by seeking the helpful so that, in the experience of that subject, it occurred frequently, by avoiding the harmful so that it, in the same manner, recurred seldom, and by simply ignoring the indifferent, could secure for itself an orderly environment. For as no experience deals with ultimate elements regarded as things *per se*, so no experience deals with the totality of things. A whole crowd may watch the moonlight on a summer sea and every wave reflect it, yet each spectator sees only the one silvery path that stretches outward straight from his own feet. In individual

experience, in like manner, each has his own centre and a restricted range. These two properties — centrality and selection — are essential to the possibility of individual experience, and so far to the possibility of any universal experience which presupposes it. There seems then to be no warrant for the assumption that the uniformity of experience is a fact independent of all percipients, as dualism maintains. The uniformity of nature with which science deals, is, we must remember, entirely conceptual. It resolves itself into a scheme of general laws, connecting objects and events, themselves always more or less abstract and ideal. If we try to picture the world as a whole, in its concreteness and yet without relation to any specified percipients, we are perplexed by diversity and complication rather than impressed by uniformity. Where is there one thing that is not also many, that is a whole and not merely a part; where one event that is not also a succession of several? Relative to a specified subject, some answer may be given. To us, for example, there is meaning in saying that a dog is one thing; but if we imagine ourselves at the standpoint of his parasitic guests, it would seem as extravagant so to regard him as to many it seems extravagant to regard this planet, in which we live and thrive, as a complete organism; despite all that the genius of Fechner has done to commend the notion to us. To us, again, the flash and crack of a discharged rifle is one event; but were our *tempo* of apprehension quickened to the pace of a gnat's, the momentary report, it has been imagined, would lengthen out into a series of varied and intermittent noises. Nay,

if that *tempo* were quickened sufficiently, even the still briefer scintillation would occupy it for ages and present we know not what variety. *Bis repetita docent*, we say; but how, with our limited span of consciousness and the infinite diversity of things, could we have any chance of two like experiences apart from that subjective interest and activity that enable us to react and to select? Surely then it is once again evident that we cannot get from dualism to experience; whether or in what sense we can get from experience to dualism remains to be seen.

It is by these repetitions then that we acquire cognitive familiarity — experience of experience, so to say — and practical facility or expertness. This implies that each new recurrence is in general an advance. A second experience of the same thing is not only not numerically, it is not qualitatively, the same experience as the first; there is this difference of further intimacy and efficiency. The thing is more clearly and distinctly known, more easily and adroitly done; and of course as the old in this way becomes familiar and mechanical, new advances are in general possible. How much of such progress lies behind any stage of experience, of which we have positive knowledge, no one can say. But as regards the advance from such stage, we *can* say that it is marked by a steadily increasing uniqueness. The more developed two individual experiences, the more truly is each one *sui generis;* 'none but itself could be its parallel.' Its objects, its acts, its memories, its aims and interests, in their concreteness are like those of no other. This is a point on which I have already

enlarged in earlier lectures, and there is no need to be detailed here; we shall have to return to it in discussing the transition to universal experience. But just now it concerns us chiefly to notice, that this increasing definiteness reveals no trace of unrelated and unrelatable elements that can only be conceived apart, but shews rather a duality in unity which we may fitly describe as an organic whole. The objects are for the subject inasmuch as they are its ends, and just so far are they properly objects. They have all the independence but also all the relativity that the term 'object' implies. But a like relative independence pertains equally to the subject. We have come upon nothing so far that can be called reality into which both factors do not enter.

We come now to intellective synthesis, under which somewhat vague phrase I propose to consider those characteristics of developing individual experience which first make intersubjective intercourse possible. Psychology distinguishes between associative and intellective synthesis; but, if what I have said of subjective selection be true, there is no synthesis without a prior differentiation due to such subjective interest and apprehension — no purely passive association of objective changes just as they occur. By intellective synthesis, however, I understand specially that which rests upon comparison, and leads to the recognition of similarity in things and events that are partly different. The comparison need not be — indeed cannot be — at first deliberate and, so to say, theoretical; it is rather suggested by practical exigencies, and here the truth of Dr. Bain's 'flash of similarity' comes in. In such ways, conation and cogni-

tion working always together, the individual subject comes to distinguish its own body or self from other bodies as not-selves, and to attribute to them also likes and dislikes, and the power to know and to do. It is obvious that the presence of other individuals of its own species within its environment, together with its peculiar interest in these, will facilitate this recognition of both as selves, and so in turn make the recognition of other sorts of selves easier. How far this identification goes it would be hard to tell, for, as Goethe has somewhere said, "Man never realises how anthropomorphic he is." At any rate, the researches of anthropologists warrant us in assuming, that when human intercourse begins there is no dualism. And now at length let us turn to this intercourse to ascertain the general characters of universal experience, and how dualism comes about.

"When ten men look at the sun or moon," said Reid, "they all see the same individual object." But not so, Hamilton replies: "the truth is that each of these persons sees a different object."[1] With these diametrically opposite statements of the two chieftains of the Scottish philosophy, we may begin our inquiry. It is obvious that they are here at different standpoints: Reid at that of universal, Hamilton at that of individual, experience. In Hamilton's sense not one of the ten sees *the* sun; in Reid's "the same individual object," which all mean, is not equivalent to the immediate experience of any one. Hamilton is right in so far as each concrete experience has its own concrete object;

[1] *Lectures on Metaphysics and Logic*, vol. ii, p. 153.

Reid in so far as common experience relates all these concrete objects to one phenomenon. It would be a vast convenience, by the way, if philosophical writers would be at some pains to distinguish these very different meanings of 'object' that here again emerge. It is mere slovenliness to call the concrete objects of individual experience phenomena; for in that experience there is nothing, as I have already urged, that answers to the distinction of appearance and reality: all here is real. 'It shines, it moves,' not 'it appears to shine, it appears to move,' would be the language of an individual percipient. The conception of the phenomenal, of course, has brought with it the conception of a further, so-called noumenal, reality beyond. How these two realities, the actual before phenomena and the ontal beyond, are related does not for the present concern us; it is enough to avoid confusing the two.

Our first question is to get clear ideas as to the relation of the ten different (actual) objects of Hamilton's statement to the one identical (phenomenal) object of Reid's. The question naturally presents itself in the form: How does the one sun become an object to ten different men? Yet the proper form rather is: How, and in what sense, do the ten come to know that the actual object of each is the same individual object for all? For except on the basis of individual experience communication is impossible. Yet obvious as this admission is, it carries consequences that are usually forgotten, so dominant has the universalistic standpoint become. Now if the several subjects L, M, N . . . . could, so to say, change places and the presentations of one become

accessible in their actual entirety to the others, then it might be possible to ascertain directly how far the object of one was comparable or identical with that of another. But it is superfluous to say that this is just the most impossible thing in the world. Individuality implies *inter alia* just this impossibility. So, when we speak of the totality of a given experience as Ego and non-Ego, we regard such totality not merely as a logical, but as an actual concrete, universe. In this wise, Leibniz, for example, conceived each of his monads as mirroring the universe from a unique standpoint of its own. Thus when in place of the Ego L we have M or N, so too in place of the non-Ego non-L we have non-M or non-N. The most, then, that L can indicate or communicate to M of any part of his own experience, is so much of it as is common to the experience of both. We may be sure the earliest intercourse fell very far short of this, and even now the maximum is probably never attained. The process apparently begins with simple indications: we point to a particular thing as this or that, and then — if it be "something more than phantasy" — each has "the sensible and true avouch of his own eyes" that such particular is numerically identical in their several experiences.[1] And even the description of this particular must, it would seem, rest ultimately on indications. We point to other particulars that we find resembling it — other shining, moving, round objects; and so, by suggesting its likeness to these, take the chance that parallel relations or com-

[1] In the case of ten hungry men and a loaf, for example, this object-lesson would be impressive.

parisons will be verified by our fellow-men. That great differences may exist undetected between the particulars of one man's experience and the corresponding particulars of another's is shewn by the facts of colour-blindness. Of these the world was ignorant till Dalton, the great chemist, appearing at his Quakers' meeting in scarlet hose, was led to investigate the anomaly. In no case, then, can the particulars of experience be communicated, whether they be objective or subjective, qualities or intensities either of sensation or of feeling. This is the kernel of truth which the sophist Gorgias tried to turn to sceptical account in his paradoxical contention that even if there were any knowledge it could not be communicated. So far as reality consists in particulars, so far it pertains to each experience for itself alone; and so far the solipsist in theory and the egoist, or the solipsist in conduct, are logically unassailable; even though the proper place to put them be, as Schopenhauer said, the madhouse. All communication begins and ends in establishing relations between these primary *realia* of the communicants; so far as this is achieved they are said to understand each other. Language, soon superseding mere gesture and exclamation, becomes the medium of such understanding, and the two mutually advance together.

Without this intersubjective intercourse mankind would remain a herd; with it they become a society. The common knowledge that results might be roughly distinguished as practical, historical, and theoretical, including under the last both science and philosophy. It is with this theoretical knowledge that we are now

directly concerned, for it is here that the problem of dualism becomes explicit and acute. Nevertheless the other forms of knowledge are worthy of remark, since each of them contributes an element to the problem. A knowledge of another's experience sets us upon doing and trying for ourselves, and thus the immediate experience of every member of a society is, in some degree, extended through that of the rest. Such advance, by ensuring greater practical efficiency and foresight, brings with it a growing sense of power to shape a plastic environment to human ends. But this sense of mastery Naturalism, as the logical outcome of dualism, declares to be illusory. It maintains that we are in reality confronted by a system of matter and law which we are impotent to control.

This position, which seems to contradict and confound immediate experience on its active side, is almost equally at variance with that historical knowledge which we may call non-scientific. In so calling it we are only following old usage. Thus Bacon excluded both natural history and civil history from science in his *globus intellectualis* or encyclopædia; and he did so because such histories are confined to the concrete and particular. Hobbes, who also excludes them, does so on the ground that they are mere *experientia* and not *ratiocinatio*.[1] It is this opposition of experience as historical and practical to science as exclusively nomological which we shall do well to note in passing, and to which we shall have once again to return in later lectures.* We have it

[1] Similarly, Schopenhauer. Cf. Windelband's Rectoratsrede, *Geschichte und Naturwissenschaft*, 1894, p. 21.

* See Note iii, p. 608.

concisely and picturesquely summed up in Goethe's familiar words: —

> Grau, theurer Freund, ist alle Theorie,
> Und grün des Lebens goldner Baum.

Life is wholly an affair of the real and individual; we cannot perform abstract acts or experience abstract events; everything here has not merely general properties but a unique setting, and counts only so far as it has meaning and worth. It is not on the practical or historical side that common knowledge conflicts with individual experience, for there the reference to individual subjects is still present and essential. But intersubjective intercourse on what we may call the theoretical side leads almost inevitably to the omission of this reference; and so for the living green we have the sombre grey and Man at least "and Nature are at strife." Let us now try to see how this comes about.

It seems to depend upon three elements or conditions which are consequences of intersubjective intercourse: the notion of the transsubjective, the hypothesis of introjection, and the reification of abstractions. The meaning of this somewhat novel terminology will, I hope, become clear as we go along. We shall be mainly concerned with the first two and with the third chiefly as it is implicated in these. The term 'transsubjective'[1] has been devised to obviate the confusion of what is objective from the standpoint of universal Experience, the one individual object of Reid's ten men, with what is objective for an individual experience, the different objects of Hamilton's ten. *The*

[1] Cf. Volkelt, *Erfahrung und Denken*, p. 42.

sun as transsubjective object is not L's sun or M's sun or N's sun, — if I may so say, — but rather what is common to them all, neglecting what is peculiar to each — neglecting, in particular, that direct and immediate relation to L, M, and N severally, which constitutes for each his own non-Ego. Apart from L or M their respective non-Egos, — non-L, non-M, — are non-existent, and their respective suns in like manner. Not so *the* sun as a transsubjective object. If we ask: Since this object is not the peculiar object of any given consciousness, for what consciousness is it an object, we have at once Kant's answer: *für 'Bewusstsein überhaupt,'* for consciousness in general. Following out this answer, we might presently see that this conceptual consciousness, — absolute consciousness we may (in this context) fairly call it — presupposes and is inseparable from the individual consciousness of immediate experience; in this respect resembling the conceptual or absolute space and time already discussed. But we want first to be clear about the rise of dualism. To that end it will be sufficient here to note that ordinary thought does not raise Kant's question. It proceeds rather in this wise. Regarding *the* sun as independent of L and M and N *severally*, it concludes that it is and remains an object, independently of them all *collectively*. Such reasoning is about on a par with maintaining that the British House of Commons is an estate of the realm independent of each individual member and that therefore it might be addressed from the throne, for instance, though there were no members. This fallacy of naïve realism is one step towards dualism; the hypothesis of introjection supplies the other.

The term 'introjection' we owe to a brilliant thinker but recently taken from us, the late Richard Avenarius of Zürich. The hypothesis on which it rests is familiar enough and as old apparently as human speech; it is substantially what Professor Tylor has called animism. But to Avenarius belongs the merit of making the epistemological bearings of this primitive doctrine clearer than they were before. The essence of introjection consists in applying to the immediate experience of my fellow-creatures conceptions which have no counterpart in my own. I find myself in direct relation with my environment and only what I find for myself can I logically assume for another. But of another, common thought and language lead me to assume not merely that his experience is distinct from mine, but that it is *in* him in the form of sensations, perceptions, and other 'internal states.' Of the sun in my environment I say there is a perception in him. Thus while my environment is an external world for me, his experience is for me an internal world in him. This is introjection. And since I am led to apply this conception to all my fellow-creatures and it is applied by all my fellow-men to me, I naturally apply it also to myself. Thus it comes about that instead of construing others' experience exactly and precisely on the lines of our own,—as a duality of subject and object, — we are induced to misconstrue our own experience on the lines of a false but highly plausible assumption as to others' experience, which actually contradicts our own.* To this contradiction, latent in common thought and language, we may fairly attribute the *impasse* to which the problem of external perception

* See Note iv, p. 608.

has been reduced. With this contradiction and the fallacy of naïve realism just now referred to, dualism is essentially complete.

But, so long as the problem of external perception does not obtrude, the inconsistencies of these two positions, to which social thinking has led, remain latent and unheeded. Psychology and the natural sciences which work on the level of this uncritical thinking take each their own half of what — if they think about it at all — they suppose to be a consistent and complete whole. The one regarding 'the transsubjective' as a real world devoid of all subjective implications, and the other accepting introjection as a fact, they go their several ways, till in the end they have not a single term in common — not even time, which Kant imagined belonged alike to both. So complete is the dualism that when philosophy essays to heal the breach, it has no adequate language in which to express itself; for its new wine there are only the old bottles. To the plain man its teaching is a stumbling-block; to the man of science it is foolishness. Not merely are familiar words used in what seems an unusual and non-natural sense, but a position is challenged which the several sciences have long held to be impregnable. For what is true, men say, if it be not true that mind and matter are disparate realities, if 'what takes place in the mind' cannot be at once and always distinguished from 'what takes place without it.' Well, it is not unfrequently a sure sign of radical disease, when the patient maintains that he is in perfect health and wants no physician. Science and common thought are, I make bold to say, in this plight as regards dualism, when they

refuse the ministrations of philosophy. We can only prescribe reflexion; and happily the reflexion is sure sooner or later to come, and cannot in the end fail of its result. But it is the practice of too many philosophers in our day to defer this advice till the mischief has reached an advanced stage, and the difficulties of a thoroughgoing reflexion are proportionately increased. Let me refer to some remarks of Professor Ladd in illustration. In writing about the definition of psychology I had argued that we cannot at the outset accept the distinction of internal and external experience; not only because the reference to space which that distinction involves is confused, but because the distinction itself is one that psychology has to debate and explain. To this Professor Ladd replies: "On the contrary, no distinction seems, 'at the outset,' to be more clearly and promptly made than this by the reflective mind of all mankind. It is only after the professional student has introduced certain metaphysical discussions, which ought to be left to the later stages of psychology or to philosophy, that this seemingly obvious distinction becomes debateable and confused."[1] Had Professor Ladd but omitted the one word 'reflective,' we should have been completely in accord; for he would then merely have testified how deeply ingrained is the notion of introjection. Nevertheless this 'seemingly obvious' but really unsound distinction ought, according to that eminent psychologist and many beside him, to be left alone at the outset; because it is not the business of psychology to concern itself with philosophical questions. Nor is it, others add,

[1] *Psychology, Descriptive and Explanatory*, p. 3.

the business of philosophy to meddle in the affairs of the sciences. Such protests are doubtless the consequences of a just resentment on the part of science against the presumptuous extravagancies of a Schelling or a Hegel, and of a just repudiation of them on the part of a soberer philosophy. Taken with a grain of sense, there is truth in such contentions; but to admit them unreservedly is to err in the opposite extreme. This mistaken deference has perhaps done more than anything to facilitate the acceptance of the sort of agnostic monism we have already to some extent discussed. *Pœnitentia sera raro vera;* error then should be denounced and renounced as soon as it can be understood. If we leave this dualism of internal experience and external experience unexposed, till it has, so to say, consolidated and intrenched itself in two disconnected sciences; and only then invite philosophic reflexion to attempt their unification, what more natural than that it should declare them to be two aspects of the unknown and unknowable, and should maintain the science of the external side, as the more exact and orderly, to be also the more fundamental? No, if philosophy is really to unify knowledge, it must perforce protest against these factitious unities, which allow of no bond but the unknowable. Psychology, — the science most intimately related to logic and epistemology, — so far from accepting and building on this false foundation, ought rather to shew how the seeming rift has grown. As yet this particular branch of psychology, we might call it the psychology of intersubjective intercourse, has been rather neglected, and assuredly nothing will contribute more to its neglect than to accept, as Professor

Ladd does, the 'seemingly obvious' but really 'confused and debateable' distinction of internal and external experience.

But we have seen how this distinction has arisen. It helps to account for dualism, but not to justify it. It is quite possible for two errors to keep each other in countenance, and jointly to acquire a semblance of truth, which belongs to neither separately. And so it is here. When it is said that psychology is concerned only with internal experience, the external experience, with which it supposed not to deal, is transsubjective or universal Experience. But, as I have tried to shew, it is impossible to maintain that from the individualistic standpoint experience is all internal or subjective. We may, then, I venture to think, regard this confusion as sufficiently cleared up for our purpose. An important question, however, still remains as to the first of the twin errors to which we have traced dualism: I mean naïve realism. To that question we must next address ourselves; and so pass to the philosophical problem of unifying all experience.

LECTURE XVII

UNITY OF INDIVIDUAL AND UNIVERSAL EXPERIENCE

In what sense is the transsubjective object independent of the subject? The discussion of this question has brought out a new dualism, that of the empirical and the rational. In the end, we may say, four terms emerge — the subject and object of individual experience, and the subject and object of rational knowledge. Scientific dualism, started by Descartes, afterwards drops out the second subject.

We have now to inquire whether an 'organic unity' can be shown to exist between these. Beginning with the objects, *we find that 'content' for transsubjective experience is supplied by immediate experience. Intellectual 'forms' consist of relations between such* 'fundamenta.' *But may not new* fundamenta *emerge with the ampler parallax of universal experience? What of the categories of Unity, Substance Cause,* e.g.? *This brings us to the* subject *of such experience.*

Kant's 'originally synthetic unity of apperception' the starting-point. The shortcomings of his treatment of the categories discussed. Causality traced not to logical function but to volitional activity. In a sense Kant recognises this. Substance, however, left to logic as a dead remainder. But substances or things is a category due to the interaction of active, self-conscious subjects with their environment and to their intercourse with each other.

We conclude, then, that the subject of universal experience is one and continuous with the subject of individual experience, and that in universal experience also there is the same intimate articulation of subjective and objective factors. Experience being then one organic unity, the charge of fallacy against naïve realism stands.

Concluding remarks on dualism: the problem has been wrongly stated. Dualism, like geocentric astronomy, suffices for ordinary life; but for philosophy, a satisfactory monism is still to seek.

Naïve realism, we have seen, regards the so-called external world as independent not only of any particular subject and its experience, but of all subjects collectively and of their experience. This assumption I have called a fallacy. But, it will be said, it is only fallacious to argue that what is true of each severally is not therefore true of all collectively, when the collective whole has some property which the isolated individuals have not. Mortality, for example, is as true of every collection of men as it is of any individual man. It needs, then, to be made clear that the objects of collective experience are not as independent of humanity as they are supposed to be of the individual experient. It *may* be that the new elements that enter into collective experience entail the same implication of subject and object, and that the whole constitutes an organic unity, just as we found was the case with individual experience. Still, we ought to make sure. I have, indeed, tried to shew that this is true in the special cases of space and of time. But let us now consider in general the relations between individual experience and universal or collective experience, when both exist. This, as I have already said, is precisely the question that ordinary thought ignores when it rushes straight into dualism instead.

If we hold it true that all experience implies both subject and object, then we must find a subject for universal experience; * and of such subject we must say that it is as essential to *its* objects — *the* sun, *the* earth, and the rest of what we call together nature — as the individual percipient to the immediate sensory and motor

* See Note v, p. 609.

events of its own objective continuum. What then is this second subject, and what precisely are its objects? Kant's answer, already referred to, is that it is the subject of consciousness in general, a sort of universal consciousness intuiting conceptual objects in absolute space and time. We have, then, in all four terms — the subject and object of individual or perceptual experience, and the subject and object of universal or conceptual experience; and we have to ascertain the relation of the second pair to the first. This, I say once again, is the epistemological question which the sciences ignore. Psychology and the natural sciences together take three of the terms, both the subject and object of individual experience, but only the object of universal experience. Then, regarding the two objects as disparate and the second as independent of the only subject recognised, these sciences become at once committed to dualism, and acquire that tendency to treat the conceptual objects as things *per se* which leads on to materialism. If we ask how this matter becomes known to us, we get the familiar answer: Through the senses; our sensations are partly copies, partly symbols, of it. If we ask, again, how we know this, then the puzzling problem of external perception begins. This problem British philosophy essayed to solve, taking account only of the said three terms. The rationalistic thinkers of the Continent prior to Kant had meanwhile introduced, under the name of reason, or pure thought, what we have called the second subject. The only result of that was then a new dualism,—the dualism of experience and reason in addition to the dualism of matter and mind. For

reason was regarded as independent of sensory experience, and its objects as possessing a higher, or noumenal, reality, discovered by the use of innate principles.

It is this dualism that, with a somewhat altered face, meets us when we inquire concerning collective experience and its relation to individual experience. Yet, notwithstanding this change of face, the old contrast of reason and experience has a bearing on our question; and that in two respects. First, we have the fact that the foundations of modern naturalism were laid by Descartes, who was at once both dualist and rationalist. The mechanical theory, the corner-stone of naturalism, is due mainly to him — I say mainly, because if we examined its history more closely, we should have to credit Galileo, Kepler, and even Hobbes, with an important share in that great enterprise. But, whereas the rationalism of Descartes infused a very decided idealistic tincture into his philosophy, — witness his famous *Cogito ergo sum*, his criterion of truth, his conception of God, — modern naturalism, though it has retained and extended his mechanical theory of nature, has left all these idealistic implications aside. The rational structure remains, isolated and independent, without the reason which gave it being, and on which it ultimately depends. In the second place, the old antagonism of rationalism and empiricism interests us here, because their reconciliation was one prime motive of Kant's critical philosophy, and that philosophy helps us a long way towards an answer to our question. For in Kant's philosophy we have all our four terms, — the subject and object of individual experience, and also

the subject and object of universal or rational experience. But they are no longer severed. According to his well-known saying: "Perceptions without conceptions are blind, conceptions without perceptions are empty." In other words: If we imagine the two experiences completely sundered, the one is devoid of all generality and necessity, the other of all real content; the one alone gives only the raw material of general knowledge, the other only empty form. The two subjects, then, must be at bottom the same individual, and the two objects must be synthesised into one.

Not so Descartes. Roundly stated, his doctrine reduces the percipient subject to a mere automaton, while the rational subject attains *a priori* to a knowledge of the real *per se*; thus for him the two experiences are essentially independent. When Naturalism, then, drops out the idealistic factors from the Cartesian scheme, we have the odd result just noted—a result which we have already, in the earlier lectures, examined, perhaps at inordinate length. We have, that is to say, the consciousness of an automaton on the one side, on the other a purely mechanical system; and we have no means of relating the two. True, this mechanical system is said to be only phenomenal, but this, as I have tried to shew, does not really mend matters so long as we are asked to recognise epiphenomena as well, and so long as the phenomena are declared wholly independent of and disparate from these. We have indeed, only the further contradiction of a phenomenon *per se*. This logically barbarous notion, and the dualism of experience and reason from which it sprang, Kant helps us to clear away, and if we follow up what

he began, we may hope to find both disappear. This will be the business of the present lecture. But let me first recapitulate.

In the preceding lecture the naïve dualism of ordinary thought and language was traced to the union of naïve realism, based on the notion of the transsubjective, with the hypothesis of introjection or animism. We have now seen further that, as scientific knowledge and philosophic reflexion advanced, this naïve dualism led on to a further dualism of the empirical and the rational, such as we find, for example, in the Cartesian philosophy and its developments. We have thus, in a manner, four terms and their relations to consider; viz. the individual subject and its sentient experience on the one hand, reason and its innate or *a priori* ideas on the other. Naturalism with the help of a spurious empirical psychology has got rid of reason, resolving it in common with perception into internal experience or the epiphenomenal, but retaining the mechanical scheme of the Cartesian rationalism as a universal and necessary system, a world of phenomena *per se*, prior to and independent of all this internal experience. It is this logical monstrosity, this hybrid of empiricism and dogmatism, trunk of brass and feet of miry clay, that epistemology menaces and has begun to overthrow. And Kant, *der Alles Zermalmende*, has been here the chief iconoclast. We are, however, not now directly concerned with his destructive criticism; we have rather to turn to account his reconstruction, as far as that is sound, and to carry it forward.

Let us recall once more what our problem is. Our discussions up to this point make a more precise state-

ment of it possible. The dualism we are seeking to refute is, we have seen, a consequence of intersubjective intercourse. In individual experience, taken alone, there is no such dualism, but only a duality of subject and object in one articulate whole. So much a whole indeed that, as we have seen, the tendency was to treat the objects of this experience as merely subjective modifications. Only for the new experience that intersubjective intercourse brings about was the distinction of subject and object allowed to be well founded. But if a new order of objects thus emerges, transsubjective objects in contrast to the so-called subjective objects of individual experience, we naturally ask how are these new objects related to the old, and for what subject are they objects? Is it not possible that such subject and those objects make one experience, constitute also an organic unity? Though rationalism gave in one way an affirmative answer to this question, it only did so by setting up a new dualism between reason and sense.* We ask then further: Is it not possible to unite both these into one experience, while still preserving the leading characteristic of each? Not only possible, but the only possibility, is the answer of the critical philosophy; taking the marks of a purely sensational experience to be concrete and particular 'positions,' and the marks of rational experience to be universal and necessary propositions.

Keeping for the present to this formulation of the question, let us inquire if such a connexion between the two subjects and the two objects can be made out. Beginning with the latter: the transsubjective, as distinct from the sensory, object is, as we have seen, always

* See Note vi, p. 609.

in some measure general or abstract; in other words, conceptual. Between the lizard's immediate experience —not strictly admitting of statement,—of sunshine and warm stone occurring together, and our common understanding that the sun makes the stone warm, lies this difference of perceptual and universal experience, as Kant has pointed out. But the second is only an elaboration, though a most important elaboration, of the first. The intellectual form must have the concrete filling of my own real experience before I can understand what the proposition 'The sun warms the stone' means. This proposition may be taken as a type of what is called a law of nature; it expresses not merely temporal coincidence but causal, and so far necessary, connexion; and it expresses this not merely as valid in my experience, but as universally valid. The content which my immediate experience contributes, taken by itself, is but an instance of that *consécution des bêtes*, which Leibniz used to distinguish from rational experience. Nevertheless without this content the universal and necessary factors in the said proposition lapse into empty form, become as incapable of yielding experience as empty dies of minting coin. The further this intellectual process extends, the more abstract the result; as, for instance, if we were to say not, The sun warms the stone, but Ethereal undulations produce molecular vibrations. Still, however far such operations extend, their results are only valid or objective provided they rest ultimately on a basis of immediate experience. It would seem, then, that as regards objects there is no discontinuity between universal and individual experi-

ence, since the intellectual form which characterises the one consists exclusively in establishing relations within the concrete real that constitutes the other. Relations necessarily presuppose *fundamenta;* and though we cannot advance to universal experience without relations, there is nothing but these *fundamenta* of individual experience to advance from.

But granting all this, it may be said, it is still surely possible, nay actually the case, that the advance brings to light new *fundamenta,* realities that could never dawn on isolated, perceptual experience. The relations with which intersubjective intercourse begins are relations of comparison mainly, identifying the sun with other round objects, other moving objects, and so forth. But thought does more than classify: classification will not account for the categories of unity, substance, cause. The dualism of matter and mind, *res extensa* and *res cogitans*, of phenomena and epiphenomena, which could not arise for immediate experience, because of its very immediacy, may still be a necessity of thought, which the ampler parallax of mediate experience reveals. Such a position will be found expressed or implied in much of the naturalistic writing since the time of Kant.[1] This demurrer brings us to the next point in our inquiry, and there we may hope to remove it.

What of the subject of this wider whole, Kant's *Bewusstsein überhaupt* and its categories or functions? As already remarked in an earlier lecture, Kant does not satisfactorily connect these forms of thought with the sensible content upon which they are imposed.

[1] Cf. Lange, *Geschichte des Materialismus*, 3te Aus., Bd. II, p. 163.

Even after the shock to his earlier dogmatism which the reading of Hume occasioned, he still retained a strong leaven of the old rationalism; and failed in consequence to eliminate from his system altogether the dualism of empirical and rational knowledge. But this excrescence will disappear if we only follow out consistently Kant's method of reflecting upon experience itself. We cannot begin better than he did when he made 'the originally synthetic unity of apperception the highest point from which all use of the understanding and the whole of logic depend.'[1] Not only for thought, but even for perception, this synthetic activity is fundamental and essential; so much so that, as I have already urged, we cannot resolve the humblest experience into a disconnected manifold. Again, this subjective activity is, as I have also urged, never merely or primarily cognitive. Activity devoid of all motive or impulse is no better than fate or chance; it is not spontaneity or self-activity, which is what Kant intends. But for the piecemeal fashion in which Kant was led to discuss experience he would never have severed thought from will, nor both from objects, as respectively pure thought and pure will.

Nor, had the notion of development been in Kant's day what it is now, nay, had Kant but paid more heed to Leibniz's principle of continuity, he would never have been content to write that famous sentence concluding the introduction of his first Critique:— "There are two stems of human knowledge, which perhaps may spring from a common but to us unknown

[1] *Kritik der reinen Vernunft,* 2te Auf., *Analytik,* § 16.

root, viz., sensibility and understanding; by means of the first objects are given to us, but by means of the last they are thought by us." It is a short step from such a dualism to that of epiphenomena and phenomena. And the one is as hopeless as the other. In Kant's case, the years he is supposed to have spent in finding and 'deducing' his table of categories and in devising schemata to connect them with perceptions,[1] together with the reams and reams of exposition and opposition that this strange medley of formal logic and faculty-psychology has called, and still calls forth, — all this is fair presumptive evidence of hopeless failure. And yet Kant's failure partly supplies its own remedy, in the admissions that he is driven to make and in the mediating terms he is forced to introduce. After all, though in spite of himself, it comes out clearly that sensibility or individual experience is not devoid of synthetic activity, is not purely receptive and in no respect formative. And plainly, if it were, the gradual advance up to the stage at which intersubjective intercourse can begin would be inexplicable. The brute that has not, and the child that has not yet, 'pure understanding' ought to make no progress at all. But even the preliminary, anoetic[2] or rather hyponoetic forms of synthesis, such as assimilation, association, and the like, which Kant has to call to his aid, are by themselves inadequate. The word '*Handlung*' in his native speech, or as we might say 'handling,' used to describe an action, and again the reference to

[1] Cf. Adickes, *Kant's Systematik als systembildender Factor*, pp. 17 ff.
[2] Cf. Stout, *Analytic Psychology*, vol. i, p. 50.

the tongue in the word 'language,' might both have suggested to Kant, and indeed to the earlier psychologists generally, a factor in experience still far too much overlooked. As Paulsen has well said: "This practical analysis and synthesis, which the hand performs on things, is repeated in the analysis and synthesis which the understanding applies to perceptions. To the tools of the hand correspond the conceptions of the understanding. . . . That active attitude of man towards perceptions which the brute allows to glide passively by, is due primarily to his possession of hands ever ready experimentally to interfere in the course of phenomena."[1] Language again, the indispensable instrument of most of our thinking, seems due first of all to emotional reactions that testify to man's livelier interest in his environment. And when, in consequence of the coöperation and communication that are in these ways possible, the spheres of individual experiences begin both to overlap and to be more definitely centred, and such categories as Substance and Cause come into play, we are not left merely to find these categories, taking formal logic as our guiding thread, holding ourselves happy to have found them all, but unable to connect them organically.

But with Kant's round dozen of categories we have little concern. His whole enterprise in this matter is unique as an instance of perverted and worse than fruitless ingenuity. What Schopenhauer said is here much to the point, "It is remarkable," he observes, "that Kant, whenever he wants an example for clearer

[1] *Einleitung in die Philosophie*, p. 423.

exposition, almost always selects the category of causality; for the simple reason that the law of causality is the actual, but also the only, form of the understanding, and the remaining eleven categories mere blind windows."[1] Certainly, Substantiality and Causality are what mainly concern us, and there is much truth in Schopenhauer's contention that Substantiality is through and through Causality. More of this, however, later on. The long and short as regards causality is, that the correlatives cause and effect cannot be found in any functions of thought belonging to formal logic, for this is independent of time; nor in modes of time, for these are independent of logic; nor, therefore, in any imaginary schematism of the two. But very certainly are found, and found first of all — whatever be their validity — in our own doing and suffering. It is not enough, I repeat, to recognise in imagination and kindred processes a sort of blind intellection mediating between sensibility and pure thought. Thinking is doing, and like all doing has a motive and has an end. Kant's *logical* Ego functioning spontaneously out of time is but a chimæra buzzing in a vacuum and feeding on second intentions; that it is the thinnest of abstractions, he himself allows.

But this defect of his first Critique Kant in some measure makes good in his second. Here we have a self-determining will, and not merely a supreme logical centre, the *ne plus ultra* of impersonality. Unfortunately, however, Kant's practical subject is as much in need of mediating forms of activity, if we are to connect indi-

[1] *Sämmtliche Werke*, Bd. ii, p. 529.

vidual with universal experience, as we have found his logical subject to be. If the consciousness of active initiation does not arise till the moral imperative *I ought* discloses the practical *I can*, there is a hopeless gulf between the individual man as merely conational and Man as rational. We cannot see how to get from the one to the other; and so failing, the rift of dualism is sure to extend. With this second dualism of Kant's — a dualism in the practical sphere — we must be content to deal in a like summary fashion. The relation of both to our main problem is too indirect to justify more. We are only concerned to find the same continuity between the subject as practically rational and the subject as merely conational, as we have found between the concepts that belong to the one and the percepts that belong to the other. It may suffice then to remark that without concrete springs of action self-determination is meaningless; so far, a knowledge of Butler might have saved Kant from some mistakes. We may say generally of Kant's philosophy that it is marked by one characteristic defect of eighteenth-century thought — a want of historic sense. Such a defect was the natural, perhaps the inevitable, consequence of the state of knowledge at the time. The mathematical sciences had a tremendous start; the biological sciences hardly existed; history was held to be essentially unscientific; and a building or a town furnished the type of what a completed system of knowledge would be. Sharp divisions, line and rule, symmetry of compartments, and so forth, are the leading ideas of Kant's '*Architectonik*.' The conception of evolution has

placed the last century on a better platform; and the present, we trust, may quite outgrow the dualism of reason and experience as well as the dualism of matter and mind, both which we owe to the mathematical rationalist, Descartes. From our standpoint we have no difficulty in seeing that activity is the main feature of experience. "Conduct," said Matthew Arnold, "is three-fourths of life;" and without unduly extending the meaning of the word, we find this true of all life as far as we can clearly observe. Presentation, Feeling, Conation, are ever one inseparable whole, and advance continuously to higher and higher forms. But for the fact that psychology was in the first instance studied, not for its own sake, but in subservience to speculation, this cardinal importance of activity would not have been so long overlooked. We should not have heard so much of passive sensations and so little of active movements. It is especially interesting to find that even Kant at length—in his latest work, the posthumous treatise on the *Connexion of Physics and Metaphysics*, only recently discovered and published—came to see the fundamental character of voluntary movement. I will venture to quote one sentence: "We should not recognise the moving forces of matter, not even through experience, if we were not conscious of our own activity in ourselves exerting acts of repulsion, approximation, etc."[1] But to Maine de Biran, often called the French Kant, to Schopenhauer, and, finally, to our own British psychologists, Brown, Hamil-

[1] *Das nachgelassene Werk Immanuel Kant's: u. s. w.*, edited by A. Krause, 1888, p. 78.

ton, Bain, Spencer, is especially due the merit of seeing the paramount importance of the active side of experience. To this then primarily, and not to any merely intellectual function, we may safely refer the category of causality.

But there still remains the category of substantiality, which before all others is the stronghold of the Cartesian, nay, of all, dualism. There is certainly little or no analogy between the subject of experience and the conception of substance, as applied to matter both by Descartes and by Kant; indeed Kant, as we know, in his first Critique denies that substantiality is predicable of the conscious subject in any sense. And plainly such a view, if we must still allow material substance, does not abate the rigour of the dualism we are striving to transcend. We are not, I imagine, concerned to resuscitate the rational psychology of the Leibniz-Wolffians which Kant demolished, in order to establish the immortality of the soul on grounds which equally prove the immortality of atoms. We are content to hold — at any rate are only justified in holding — that the unity and constancy of the subject of experience are due to the nature of its activity, not to an unchangeable substratum, of which thought and will are but attributes or accidents. What, then, is the source and the validity of this conception of an unchangeable substratum as applied to things? All that we know of anything resolves ultimately into changes that it produces in other things or undergoes through them. With different things these changes are different, and so we attribute to each definite properties. And, but

that such analysis seems inexhaustible, we might arrive at length, as in thought we do arrive, at the bare position of this or that without anything to distinguish one thing from another. Into such a *caput mortuum* material substance always has, and, we may safely say, always will tend to resolve itself. We cannot with propriety call it real or actual, for real and actual, as Lotze has pointed out, are predicates, and that is just what substance can never be. The changes which constitute the whole of our direct experience of things can, then, in no way be explained by this bare potentiality of everything and actuality of nothing. Science generalises these changes into a system of laws; but an unchangeable, indeterminate substratum will not account for determinate laws of change, nor they for it. The only conception that is of any avail here is that of determinate substances or things, and this at once brings the category of causality to the fore, and enables us, instead of saying, No causality without substantiality, to say, No substantiality without causality.[1] This change of front philosophy owes to Leibniz, and has seen no reason to abandon since. A world of such determinate things, in orderly interaction, may well lead our thought forward to a Supreme Principle that maintains it all. But such an *omnitudo realitatis*, or self-subsistent Being, is the very polar opposite to matter, the equivocal substance of Descartes that only gives content to the empty extent of space; and to matter, the phenomenal substance of Kant that only adds permanence to the empty extent of time.

[1] Cf. Wundt's *System der Philosophie*, p. 312.

In the form which science has now given to the conception of matter, if it remains the substratum of anything, it is the substratum of quantity. Descartes lays stress on the spatial, and Kant on the temporal, aspect of this quantity. "Corporeal substance," says Descartes, "when distinguished from its quantity, is confusedly conceived as incorporeal."[1] "In all change of phenomena," says Kant, "substance endures, and the quantity of it in nature is neither increased nor diminished."[2] Kant calls this conception dynamical; but as we now understand the term dynamical, matter has no title to the name. Dynamical relations require substances or things, and so imply some degree of individuation, imply number. But there is a world of difference between quantity and number. To this difference the conception of matter gives us no clue. It ought not, therefore, to surprise us to find Kant, in the course of expounding his principle of substance, slide over from the singular to the plural, without the faintest justification for the change. The same deadlock we find again in Descartes, and we have seen it also in the modern mechanical theory. We can regress from substances or things to substance; but can find no way back from substance to substances. We may conclude, therefore, that this category of substratum is not an element in experience, whether individual or universal. It answers to nothing real, but is simply a logical residuum, τὸ ἄπειρον. So long and so far as we can determine we have form; and form is essentially causal. The residuum at which for the

[1] *The Principles of Philosophy*, pt. ii, § 9. [2] *First Analogy.*

time we halt is matter, the determinable, but as yet, for us, undetermined.

But of a definite or real thing we may say — No substantiality without causality, and for this valid category we *can* find a source in experience. But we cannot trace it either to the subject alone, as merely cognitive, nor to the object alone, as merely 'given.' We owe it to the interaction of active subjects with their environment, and to their intercourse with each other. As experience extends in objective range, it changes in its subjective character. We advance from bare consciousness to self-consciousness, and from less reflective to more reflective forms of this. As our acquaintance with other selves extends the better we know our own self. The more we realise the permanence, individuality, efficiency, and purposiveness of self, the more the mere continua of perception and association become an ordered world of distinct things. Thus universal experience, like individual, is a growth and development, not a cut-and-dried sorting according to ready-made, hard, and fast forms. Words would be wasted in any further attempt to prove or illustrate this in detail. I will quote instead a few sentences from Dr. Caird's admirable treatise on Kant, directed against that dualism of universal and individual experience, with which Kant's thought was more or less infected. The point on which we have to insist is that "the development of the consciousness of objects cannot be separated from the development of self-consciousness." "When we consider the matter more closely," says the Master of Balliol, "we begin to see that as within and without, subject and object, are strictly correlative, so

the presence or absence of a knowledge of the one cannot be separated from a presence or absence of a knowledge of the other. . . . All ignorance of the object is ignorance of self, all development of consciousness is also a development of self-consciousness. To say that we know nothing purely *a priori*, but only gradually come to know the world as it reveals itself to us, is another way of describing the same fact, which is expressed when we say that our conscious life is the realisation in us [the gradual, progressive realisation—I take it] of a perfect intelligence."[1]

We may conclude then that the subject of universal experience is one and continuous with the subject of individual experience; that in the conceptions of universal experience there is the same mutual implication, the same intimate articulation, of subjective and objective factors. And since we have seen that the conceptions of this universal experience depend upon the perceptions of individual experience, which they elaborate by analysis and resynthesis, we conclude that experience is throughout one organic unity.*

If so, we can now substantiate our charge of fallacy against naïve realism; for the demurrer that led us to suspend it has been completely removed. The wider world of intersubjective intercourse, the transsubjective world, is indeed independent of the individual percipient as such. Or, to be more exact, and to obviate a possible misconstruction on the lines of the old Sorites sophism, the difference of his presence or absence is infinitesimal. But this transsubjective world

[1] *The Critical Philosophy of Kant*, vol. i, pp. 423 f.

* See Note vii, p. 610.

is not independent of universal experience, but the object of that experience. But once again, I say, the subject of universal experience is not numerically distinct from the subject of individual experience; but is this same subject advanced to the level of self-consciousness, and so participating in all that is communicable, that is, in all that is intelligible, in the experience of other self-conscious subjects. Universal experience is not distinct from all subjects, but common to all intelligents, peculiar to none. We can thus imagine the world without L or M, but we cannot conceive it apart from all subjects — without *conceiving* it. But that is to bring it again into relation with subjects, or rather to leave it still as universal object. If it be true to say that apart from sight there is no colour, apart from hearing no sound, and generally apart from sense no sensible world, it is every whit as true to say that apart from intelligence there is no intelligible world. Intersubjective intercourse secures us against the solipsism into which individual experience by itself might conceivably fall, but it does not carry us beyond the wider solipsism — if I may so term it — of Kant's consciousness in general, *Bewusstsein überhaupt*. You cannot dismember percipient and percept, individual subject and concrete object, into *two* distinct and separate things: here there is only duality in unity. As little can you dismember universal, conceptual experience into an abstract logical subject *per se* on the one hand and negative conceptions of things *per se* on the other. In both cases the attempt leaves us with an indeterminate X on the one side, which we have no

right to call a subject, and on the other an indeterminate X, which has as little claim to be called an object. An absolute disarticulation of experience is impossible. This is the lesson we learn from Kant.

And when we have learnt this lesson thoroughly, we begin to see that the problem of dualism has proved intractable largely because it has been wrongly stated. There is no hindrance to the solution of a question so great as a faulty formulation at the outset. This is a truth illustrated at every turn by the whole history of human knowledge. And so with dualism. Before serious reflexion upon knowledge has begun, we are started upon a false issue by naïve realism, the sources of which I have attempted to describe. Imagine two physicists saying: "Here is a magnet; it has contrary properties at opposite ends. Let us divide and conquer." "I will take away the south pole to my laboratory and investigate that," says the one; "and I will do my best with the north pole in mine," rejoins the other. This is what happens when psychologists propose to study internal experience, and naturalists external experience, exclusively. Our imaginary physicists when they get to work find, the one that a north pole, the other that a south pole, has turned up at the fracture of the original magnet. The psychologist in like manner finds objective elements in his internal experience; but he calls them subjective modifications, and the physicist in external experience finds subjective elements, but he calls them laws of nature. When the imaginary physicists meet again and join up the magnet, each is puzzled to know what is gone with the new pole that

he had discovered. Similarly with the psychologist and the naturalist: except that the joining up is here the serious business. All your side is subjective modification, says the psychologist, perhaps. No, all your side is laws of nature, the naturalist then replies. Or the psychologist, having treated intelligence, in sensationalist fashion, as a mere outgrowth of isolated individual experience, and the naturalist having treated universal experience as mere nature divorced from mind, they agree that the objects of the one are copies, the objects of the other originals, and then comes the riddle of their extraordinary correspondence. I know of no one who has put this point so ably as Ferrier, to my thinking far the most brilliant Scottish philosopher since Hume. I feel it would be unseemly to apologise for quoting some sentences from him. Nor is such quotation superfluous, for Ferrier, nowadays, seems but little read. "Our intercourse with the external universe," he says, "was the given whole with which we had to deal. The older philosophies divided this given whole into the external universe on the one hand, and our perception of it on the other; but they were unable to show how these two, the objective and the subjective, could again be understood to coalesce. Like magicians with but half the powers of sorcery, they had spoken the dissolving spell which severed man's mind from the universe; but they were unable to articulate the binding word which again might bring them into union. It was reserved for the speculation of a later day to utter this word. And this it did by admitting *in limine* the distinction; but,

at the same time, by showing that *each* of the divided members again resolves itself into *both* the factors, into which the original whole was separated; and that in this way the distinction undoes itself. . . . [But] unless we are able to think two things *as two* and separated from each other, it is vain and unreasonable to ask how they can become one . . . In the same way, with respect to the question in hand. There is not a subjective *and* objective before us, but there is what we find to be an indivisible subjective-objective, when we commence by regarding what we imagined to be the pure subjective, and there is what we find to be an indivisible subjective-objective also, when we commence by regarding what we imagined to be the pure objective. So that the question respecting the nature of the connexion between the subjective and the objective comes to be either this, What is the nature of the connexion between two subjective-objectives (but this is not the question to which an answer was wished), or else this, What is the nature of the connexion *between one* thing, one thing which no effort of thought can construe as really two?"[1]

But, after all, it is not enough to 'scotch' a snake; it is necessary to kill it. Dualism has been refuted many times, but it has wonderful powers of recovery. Philosophy may constrain 'common-sense,' for the nonce, to recant, but, like Galileo before the Inquisition, it still mutters its *E pur se muove.* An ominous instance that for me, you will say. For me, perhaps, it is. But it will only afford solid comfort to the dualist, provided

[1] *Philosophical Works,* vol. iii, pp. 278–284.

his persuasion of the truth of his position, like Galileo's, always becomes the more cogent the more it is examined; but that is not what we find. Philosophy admits the dualism of common language; but language has been shaped, not for theoretical, but for practical, ends. As for practical purposes, it is simplest to talk of the sun rising and setting, so, for practical purposes, it is easiest to talk of matter and mind, of internal and external experience, as distinct and separable. The use of instruments of precision is a costly and time-consuming business, and the philosophical standpoint is as cumbrous and unsuitable to ordinary affairs, and even to the departmental inquiries of the special sciences — psychology in part excepted — as the instruments of the laboratory or the observatory would be to the mechanic or the navigator. As science itself is against common ways of thinking as respects what used to be called the Newtonian philosophy, — and it took a long time before even the most reflective of mankind could be convinced that the earth did not need supporting, — so philosophy proper is against the common ways of thinking as respects dualism. But between the naïve dualism of ordinary thought and language, and the efforts of philosophy to transcend all dualism, we have this dualism of science which we have been examining. And that, as we have seen, has not only proved itself vulnerable from without, as soon as systematic reflexion upon knowledge and experience begins; but it has also proved internally more and more incoherent, as the special problems concerning the connexion of body and mind and concerning external perception have grown in

definiteness. Hence science itself, we have seen, has been driven to a species of hybrid monism, which we shall have by and by to examine somewhat further. But from what we have seen already there is small chance of that contenting us. And in saying this we touch the real difficulty. Destructive criticism is never sufficient: we look for construction as well. But, even when dualism is abandoned by reflective minds, there ensues only a struggle of diverse monisms to take its place. The agnostic monism of science, we feel, does not content us, and the idealistic, or, as I would rather say, the spiritualistic monism of certain philosophers is unacceptable to scientific speculation. Still, here again there is progress. How far we can transcend agnostic monism, how far we can establish a spiritual monism — these are the problems that remain to us. From a world of spirits to a Supreme Spirit is a possible step. So far as we succeed in solving these problems, then so far we shall have secured a basis for a Natural Theology.

PART V

SPIRITUALISTIC MONISM

LECTURE XVIII

CAPITULATION OF AGNOSTIC MONISM

Neutral or agnostic monism tends to degenerate into materialism; but it might logically advance to idealism. If so, the teleological must be shown to underlie the mechanical. The difficulties of the mechanical view not remedied by preaching agnosticism. But on closer scrutiny such agnosticism contains admissions which lead on to spiritualism. Thus Huxley confesses (a) *that 'our one certainty is the existence of the mental world,' and* (b) *that 'the notion of necessity has a logical not a physical foundation.'*

The conception of natural law examined. — 1. *It is teleological in its origin as an organon or means of interpreting, and so controlling, Nature.* 2. *It is teleological in its character, in so far as it is a postulate or hypothesis. We here come upon the epistemological problem of Hume and Kant,* viz., *to determine the character of general propositions relating to matters of fact. The evidence of such propositions neither immediate nor logical. Hume failed to explain them by association and remained a sceptic. But he made clear to Kant an alternative which he could not himself see. For him the human mind was but "a bundle of perceptions"; though he was hopelessly at a loss to find the "principle" that unites the "bundle." This principle Kant declares to be the synthesizing activity that yields self-consciousness. In this activity we are to find the source of the conception of nature as a system of unity and law.*

In the lectures immediately preceding we examined the dualism of ordinary thought, ascertained certain primitive misconceptions in which it first originated, and exposed

certain false abstractions by which it has been since maintained. But it may be said, and said truly, that all philosophies are faulty somewhere. Unless, then, we can find monism beset with fewer difficulties, dualism, which holds the field, sufficing for daily affairs and the routine of science, will surely keep it; mankind at large will be content, as before, to get along without a final philosophy. If, however, the desiderated monism is forthcoming, the practical conveniences of a dualistic phraseology will prevail against it as little as our familiar use of the language of the Ptolemaic astronomy against the new astronomy of Copernicus and Newton.

There are three leading forms of monism, viz., Materialism, Idealism, — or, as I should prefer to say, Spiritualism, — and the Neutral or Agnostic Monism now in vogue among scientific men. The first we may safely ignore: science no longer directly defends that. The last, however, seems to call for consideration, as well because of its wide acceptance, as because of its supposed merit in avoiding the absurdities of materialism and the difficulties of dualism. But this monism is scientifically popular mainly because it is still essentially naturalistic, and disparages the so-called psychical aspect as epistemologically subordinate to the physical. Thus whatever objections we have found to lie against naturalism are valid against a monism that is naturalistic. Again, this monism escapes the absurdities of the old materialism more in seeming than in fact. Whereas that was dogmatic, this is agnostic, is materialism without matter, materialism with most of its consequences, but divested of its metaphysics. For in this monism the mechanical theory is still regarded as

furnishing a concrete and complete presentment of the objective world, and as excluding all possibility of subjective interference. Matter, indeed, is resolved into the unknown and hypothetical; but spirit is not merely so resolved: even its supposed manifestations of spontaneous activity are declared illusory. Finally, this monism escapes the difficulties of dualism only by falling itself into the opposite extreme. The essential characteristic of experience we have found to be a duality in unity. As dualism is incompatible with the unity of experience, so naturalistic monism is incompatible with the duality. Subject and object cease to be coöperant factors in one process of life and experience, and lapse into concomitant aspects of a single and unknowable process which is neither life nor experience. The concave side of a curve cannot interact with its convex side, or the reflexion of a figure in a concave mirror with its reflexion in one that is convex. Nor can we say that the curve is in itself more convex than concave; or the image in one mirror truer to the original than the image in the other. So it is maintained that the Unknown and Unknowable is not more matter than mind, not more subject than object, Ego than Non-Ego. It is on this account that I have ventured to describe this monism as both agnostic and neutral. But the neutrality, as we have seen, is neither strict nor impartial. Indeed, from the nature of the case, how could it be? Allow that the ultimate essence of matter and spirit is unknown and unknowable, even then the practical question is, which of the two is better known? In raising such a question we are at once confronted by another, that is, how we are to estimate the comparative

importance of different forms or qualities of knowledge. But however we settle this preliminary but weighty question, the result is bound to affect our theories. And so the monism we are considering, preferring calculability to intelligibility, simplification to meaning, materialistic to spiritualistic terminology, leans to the materialistic side. Yet even then it is unstable, oscillating between the two positions — pronounced materialism and unmediated dualism — which it is supposed to transcend. We find it, in fact, inclining now to the one, now to the other, as the stress of each new problem determines; while the obscurity of the unknown and unknowable serves to cover its vacillations. Disregard this unknowable, or take it for what it is worth, and the net result is but a hybrid of hazy dualism and halting materialism. If dualism is unsound, there seems to be no agnostic resting-place between materialism and spiritualism.

Our whole interest in such a temporary position lies in the possibility that this labile monism may after all lapse in the opposite direction. Signs of such a change in scientific thought are by no means wanting, and it is only as we are hopeful of them that we can call agnostic monism an advance. But what does such a transition in the idealistic direction imply? Let us enter upon this inquiry just as it presents itself, from the standpoint of the new monism, that is to say. First, if it be true that the two aspects, the psychical and the physical, of a supposed Unknowable exactly correspond, though they cannot interact, then whatever be the order and connexion on the one side, there will be an identical order and connexion

on the other.[1] If the characteristics of one be teleological, so in like manner will be those of the other; if the characteristics of one be mechanical, those of the other will be mechanical too. But now, we must take it as certain at the outset — not a matter of theory but a matter of fact — that the characteristics of the side of life and mind are *prima facie* essentially teleological. At the same time it is maintained — but on theoretical grounds — that the characteristics of the physical side are ultimately and absolutely mechanical. By the fundamental position of this monism, however, both cannot be right. Either there is illusion on the one side, or the view taken of the other is logically erroneous. It is here that the need for a theory of knowledge becomes paramount. But Naturalism, regardless of this need, has straightway, and, as it begins to appear, has too hastily, decided for the first alternative. The strict mechanical necessity of the physical side is upheld, and, as a consequence, the spontaneity and purposiveness of the psychical side is declared to be illusory, a thing to be explained away. Again, as events on the physical side are of one order, mass-motions, so those on the psychical side must, it is said, be of one order — a flux of presentations or feelings; what we call thought and will can only be complexes of such feelings or presentations: the changes and complexes of the Unknown as matter-stuff on the one side are changes and complexes of the Unknown as mind-stuff on the other. But while the physical world is held to be complete in itself, there are no psychical

[1] Cf. Clifford, as quoted above, Lecture XI, pp. 13 ff.

laws that suffice either to connect individual minds together or to connect the successive 'feelings' of the same mind one with another. The mechanical series is therefore regarded as if it conditioned the seemingly teleological series, and — spite of glaring inconsistencies — mind and morals are even spoken of as collateral products of mechanism.[1] I do not, of course, propose to weary you by recalling the many detailed objections we have found to these positions as real principles, but rather to discuss the general question now raised from the more formal standpoint of epistemology.

The question is: Can the teleological supplant the mechanical, or rather, be shewn to underlie it, or can it not? It is here that the naturalist, as such, is most confident, and the moralist, as such, most depressed. The one, as Huxley has told us, foresees the tide of matter and law advancing till it is coextensive with all experience; the other conceives this advance as inevitably destroying all spirit and spontaneity. At the outset one thing at least seems clear: it is utterly fatuous to imagine that mere agnosticism can relieve us from the burden of this problem; and yet it will be remembered agnosticism is what Huxley preached to all those that are oppressed by it. But, if the supremacy of the mechanical is verily knowledge, it is childish to turn to ignorance, actual or necessary, of other things, as a refuge from it. What matters what we don't know beside, if we do indeed know this, if this supremacy at any rate is certain? Or, if what we do not know does matter, is not that but another way of

[1] Cf. Münsterberg, *Die Willenshandlung*, 1888, pp. 105 ff., 118 ff.

saying that this mechanical supremacy is perhaps not ultimate, perhaps not absolutely certain?

The truth is that this new philosophy owes its monism to the *a priori* speculations of Spinoza, while its agnosticism is borrowed from Hume and Hume's successors. Such alien elements, the dogmatic and the sceptical, the empirical and the speculative, like oil and water, refuse permanently to blend. Only one result of such an attempted combination is foreseen and accepted: the rationalism of Descartes and Spinoza, which takes geometry as the type of knowledge, will serve to secure the supremacy of the mechanical, while the sensationalism and scepticism of Hume will suffice to discredit the teleological and spiritual. But other and unforeseen results emerge. One of these we have already noticed — the instability, I mean, which leaves this new monism oscillating between dualism and materialism. From such instability Descartes with his clearly defined substances, and Spinoza, still more, with his one supreme substance, were practically free. A second result now becomes apparent. Agnosticism proves a treacherous ally even for Naturalism, and ends by undermining its dogmatic foundations. At the same time mind, though perhaps neither completely known nor completely knowable, turns out less of a fiction than matter. The incursions into philosophy, spread over many years, of two distinguished men of science, recently removed from us, Huxley and Du Bois-Reymond — afford instructive illustrations of this 'double decomposition,' to use a chemical phrase, of its rational and its empirical components, to which agnostic monism may lead. The agnosticism,

attached primarily to the spiritual and teleological, ends by fastening on the mechanical, while the teleological and spiritual appear as the truly rational and fundamental. If we examine what Huxley says when he preaches agnosticism as delivering us from the perplexities of naturalism, we shall find, I think, some evidence of this transformation.

But for clearness' sake let us first recall some statements of his that set forth the original position. "I take it to be demonstrable," he says, "that it is utterly impossible to prove that anything whatever may not be the effect of a material and necessary cause [this conjunction of 'material and necessary' is noteworthy], and that human logic is equally incompetent to prove that any act is really spontaneous."[1] And again: "If these positions are well based, it follows that our mental conditions are simply the symbols in consciousness of the changes that take place automatically in the organism. . . . We are conscious automata, . . . but none the less parts of the great series of causes and effects, which, in unbroken continuity, compose that which is, and has been, and shall be — the sum of existence."[2] Now the meaning of this and many like statements that I have previously quoted is plain and unmistakeable. It is this: Nature, to which we entirely belong, is an unbroken continuity of necessary causes, and of these our mental conditions are simply the inefficient

[1] *Collected Essays*, vol. i, p. 158.

[2] *o.c.*, p. 244. The clauses here omitted, referring to what is termed 'the feeling we call volition,' have been discussed above. Lecture XII, p. 45.

symbols. We have no knowledge how these symbols are connected with those causes, but we are confident that volitions do not enter into this chain of causation at all. "The consciousness of this great truth," Huxley has told us, "weighs like a nightmare upon many of the best minds of these days." And small wonder if it be indeed a great truth. But now let us recall the relief from this load which agnosticism is supposed to afford us. The 'great truth' is not fatalism, because, says Huxley, "I take the conception of necessity to have a logical, and not a physical, foundation;" it is not materialism, "for I am utterly incapable of conceiving the existence of matter, if there is no mind in which to picture that existence."[1] The existence of matter is inconceivable without mind, the conception of necessity has a logical, but has no physical, foundation — this does not sound like a mere declaration of ignorance, and has, moreover, a decidedly idealistic ring. Perhaps after all there *is* substantial solace here for those alarmed by the advancing tide of matter and law. Let us then examine somewhat closer these two articles of the agnostic gospel.

It is the second of them that chiefly concerns our present inquiry; but the first is important as it clears and defines the ground of the later discussion. For if necessity is logical, not physical, has its source in mind, not its home in matter, it is desirable to begin by ascertaining the epistemology, or perhaps we ought to say the agnoiology, of these conceptions, matter and mind. This Huxley gives us in the following brief sentences of

[1] *Collected Essays*, vol. i, p. 245.

reassurance: "For, after all, what do we know of this terrible 'matter,' except as a name for the unknown and hypothetical cause of states of our own consciousness? And what do we know of that 'spirit' over whose threatened extinction by matter a great lamentation is arising . . . except that it also is a name for an unknown and hypothetical cause, or condition, of states of consciousness. In other words, matter and spirit are but names for the imaginary substrata of groups of natural phenomena."[1] We may safely take phenomena here as equivalent to states of consciousness; the context itself justifies this, and Huxley's statements elsewhere are quite explicit. Indeed, we may fairly go farther and replace 'states of consciousness' by the simpler and less ambiguous phrase, experiences. We have, then, on the one hand, experiences as our facts, and, on the other, matter and mind as unknown and hypothetical causes and as imaginary substrata of these facts. The mention here of *two* hypothetical causes, *two* imaginary substrata, does not mean that the two are alternatives; so that, if one be true and real, the other is false and unreal: it means that duality pertains essentially to our experience as a fact. So far, therefore, it is obvious there can be no fear of one factor in this duality extinguishing the other, whatever may befall the causes we assume or the substrata we imagine for them. Nevertheless, it is a gross exaggeration to say that matter and mind are simply names for the unknown and unknowable; Huxley's agnostic deliverances themselves testify to the contrary. Mind is, at any rate, the name for the subjective factor,

[1] *Collected Essays*, vol. i, p. 160.

and matter the name for an objective factor in experience. In speaking of both as causes, their coöperation or interaction in experience is recognised; and calling them names for the unknown means simply that we have no experience of the subjective apart from the objective, nor of the objective apart from the subjective. To say that these mean nothing *in* experience is to treat experience itself as nothing. Again, speaking of both as substances or substrata is but to recognise the permanence in experience of both factors, and calling them imaginary is again nothing but the truism that we only know them as permanent *in* experience. To say that their permanence here is imaginary is to deny the fundamental character of experience as continuous process. Plainly, facts must precede hypotheses and fictions. Thus, while really arguing against dualism, what Huxley in spite of himself so far establishes is not agnostic monism, but merely the duality in unity of experience.

And so we come to what I just now called the first article of the agnostic gospel. It is not materialism, because the existence of matter is inconceivable without mind to picture that existence. If the words had run: It is not idealism (or spiritualism) because the existence of mind is inconceivable without a physical basis, of which it is the function and collateral product, we should have been less surprised; and, on the whole, I am bound to say, such a statement would have seemed more consistent. Nevertheless, Huxley, when this question is definitely raised, rightly refuses to assert the converse inconceivability of mind apart from matter.[1] So,

[1] Cf. *Collected Essays*, vol. ix, p. 141.

then, matter is inconceivable apart from mind, but mind is not inconceivable apart from matter. More definitely, *matter* is not essential to experience, but only a subject, and its objects or ideas. Accordingly, we find Huxley declaring "the arguments used by Descartes and Berkeley, to shew that our certain knowledge does not extend beyond states of consciousness, to be irrefragable," that "our one certainty is the existence of the mental world, and that the existence of *Kraft* and *Stoff* falls into the rank of a highly probable hypothesis."[1] And more than once he has said, "If I were obliged to choose between absolute materialism and absolute idealism I should feel compelled to accept the latter alternative."[2] The significance of this admission for our present argument lies solely in its recognition of that subjective centrality of experience, the originally synthetic unity of apperception, as Kant styled it, which we have discussed in earlier lectures. Its significance, therefore, is not impaired by any defects in the idealisms, dogmatic or problematic, of Berkeley and Descartes; for they were both essentially at one with Kant's transcendent idealism on this point. Both would have subscribed to Kant's words: "All the manifold determinations of perception have a necessary relation to the 'I think' in the subject that is conscious of them. The 'I think,' however, is an act of spontaneity that cannot possibly be due to sense." Nor, again, is the significance of this admission diminished by Huxley's contention that he is relieved from the obligation to choose by our ignorance

[1] Cf. *Collected Essays*, vol. ix, p. 130.

[2] *o.c.*, vol. vi, p. 279; vol. ix, p. 133; also vol. i, p. 172.

what matter or mind, those hypothetical and imaginary unknowns, may be in themselves. He is relieved from the obligation to choose only by the fact that he has chosen. The admission he has actually made is all we care for: we are not concerned, either with the hypothesis of dualism, that experience implies two substances, matter *per se* and mind *per se;* nor with that of neutral monism, that these two unknowns may be replaced by a single unknowable. On the basis, then, of this recognition of the active, subjective synthesis that makes every experience an owned experience, and gives it not only unity and continuity but centrality, we may now pass to the second article of Huxley's agnostic gospel.

The 'great truth' as to the advancing tide of matter and law is not fatalism, because "the notion of necessity has a logical, not a physical, foundation"; "is something illegitimately thrust into the perfectly legitimate conception of law." "For my part," says Huxley, "I utterly repudiate and anathematise the intruder." Very good; then presumably he would wish us to withdraw the term 'necessary' from the passage just now quoted, in which 'material and necessary causes' were spoken of as conceivably the only causes there are. "Fact I know, and Law I know; but what," he now asks, "is this Necessity, save an empty shadow of my own mind's throwing?" This is an odd inversion of the ordinary naturalistic positions. It reminds us at first of Kant's claim to be the Copernicus of philosophy when he maintained that objects conform to the *a priori* principles of our intelligence, not our intelligence to the independent nature of things. Necessity,

Huxley seems to say, is not physically imposed by nature on us, but psychically imposed by us on nature. But then comes the paradoxical contention that this imposition is illegitimate, since necessity is no part of the conception of law. If this contention could be sustained, the outlook would be a poor one. We should escape the Scylla of fatalism only to be lost in the Charybdis of scepticism. Either no freedom or no knowledge would be the only alternative; yet what avails freedom without knowledge or knowledge without freedom? However, further reflexion will satisfy us — as I hope presently to show — that the notion of necessity is not illegitimately, *i.e.* to say illogically, thrust into the conception of law, but is an essential part of it. Meanwhile this further concession, viz., that necessary law is wholly an ideal conception, not a physical fact, along with the idealistic basis of experience already admitted, which reduces matter to the rank of a secondary hypothesis — again therefore a conception, not a fact — these together will, I think, enable us in the end to see that the teleological, after all, underlies the mechanical; that spirit cannot be the effect of a material and necessary cause, but that necessary causes are a postulate, and matter an hypothesis, which mind has elaborated in order to render experience conceptually manageable. To this inquiry, then, we now return to pursue it on its own merits. As to the issue, it is encouraging and helpful to have found that the agnostic's proposal, to escape all further trouble about such a question by emphasising our inevitable ignorance of the self-contradictory, is based on a half-

conscious perception of the errors of dualism, and culminates in an admission incompatible with neutral monism. We may say, indeed, that agnostic monism here disposes of itself. Our one certainty is that which we have already reached in our examination of dualism, the unity in duality of experience. This I take to be the meaning of Huxley's words; "Our one certainty is the existence of the mental world." On this basis, then, let us now proceed to examine the conception of natural law.

In the first place, this conception is teleological in its origin. It is a human invention or discovery turned to account for the furtherance of human ends — as much so as the discovery of fire or the invention of the plough. Whether in enlarging his material, or in augmenting his mental, possessions, man is alike active; and his procedure in both cases is essentially the same. For both he must devise instruments and find helps. In the words of Bacon's famous aphorism: *Nec manus nuda, nec intellectus sibi permissus, multum valet; instrumentis et auxiliis res perficitur; quibus opus est, non minus ad intellectum, quam ad manum.*[1] After many attempts, through many failures, by gradual advances, has man at length secured economy and efficiency in the arts, exactness and simplicity in the sciences. Of the principles and postulates essential to the one, he is at the outset as little in actual possession, as he is of the implements and structures indispensable for the other. Nor are these necessary prerequisites discovered or revealed as existing ready-made without. Whatever the *forces* of nature may be, the

[1] *Novum Organon*, Lib. i, 2.

laws of nature are not facts, as the constant confusion of the two conceptions might lead us to suppose. Every such law was for us originally merely a hypothesis awaiting verification. Notably this was the case with one of the most impressive and wide-reaching of all natural laws — the law of universal gravitation. A mistake as to the length of a degree of latitude brought out a result incompatible with his theory, and so Newton was led to keep his speculations in abeyance for many years. And what is true of laws of nature severally is true of the conception of natural law in general: it is a hypothesis, a postulate; an epistemological condition of the possibility of scientific experience, but not itself a fact of experience. I urge this not with intent to disparage science. Sceptical arguments of that sort are really illegitimate, and rest upon a misconception of the genesis of knowledge which is poles asunder from the view I am endeavouring to maintain. If we were merely passive recipients of knowledge; if knowledge were simply 'generated' in a quasi-mechanical fashion by association, as Hume and the psychologists who follow him affirm, — then indeed there could be no talk of nature or of natural laws. On the other hand, if our earlier analysis of experience is sound, then there is no pure passivity in experience; and even the association of ideas is determined, not mechanically, but by subjective selection and interest. Thinking, at any rate, is an arduous labour, the very antithesis of amusement and relaxation; and, without thought, such universal and necessary knowledge as the conception of law implies would be unattainable. It was this view of the genesis of knowledge that Socrates

sought to express by playful allusions to the maieutic art, and Plato by his fanciful doctrine of *ἀνάμνησις*. For a process entailing such strenuous and persistent exertion there must be an adequate motive; and *that* there is in the feeling that ignorance entails helplessness and danger, whereas knowledge brings security and power. And this truth, which Bacon first realised with full consciousness of its meaning and set forth systematically, has been the prime motive of man's thinking activity throughout. In a word, self-conservation, the first law of life, is here the ultimate spring of action, and shews plainly that knowledge is teleological in its origin. But the teleological character of natural knowledge is further evinced by its originally hypothetical form. Let us now inquire farther what such form implies.

It is here that Hume is important, and especially Hume as criticised and interpreted by Kant. True, knowledge is power, it is said; and as a means to this end it is primarily sought. But to be reliable it must be certain, and the only entire certainty that we possess is either particular, confined to present impressions, or formal, restricted to the relations of ideas. Neither of these will give us prescience or control in dealing with reality. Sense-particulars have reality indeed, but they have no universality; while the logical relations of ideas have universality but no reality, in other words, are in the first instance only thought, not knowledge. The extent to which such relations will hold of matters of fact remains an open question, a question in no way affected by their truth and validity as thought. This

distinction between thought and knowledge marks the modern era of philosophy. Like all great truths, it gained ground gradually. Bacon, Locke, and Leibniz contributed in their several ways towards its recognition: Bacon by his distinction between *anticipationes* and *interpretationes, naturæ;* Locke by his distinction of archetypal and ectypal ideas; Leibniz by his distinction of truths of reason and truths of fact. But Hume placed the distinction beyond dispute, once and for all, by his analysis of the conception of cause. Whatever be the defects of that great argument in other respects, in this one point it is generally acknowledged to be invulnerable. "All the objects of human reason or inquiry," says Hume, "may be naturally divided into two kinds, to wit, *Relations of Ideas* and *Matters of Fact.* Of the first kind are the sciences of Geometry, Algebra, and Arithmetic; and in short every affirmation which is either intuitively or demonstratively certain. . . . Propositions of this kind are discoverable by the mere operation of thought, without dependence on what is anywhere existent in the universe. . . . Matters of fact are not ascertained in the same manner; nor is our evidence of their truth, however great, of a like nature with the foregoing. The contrary of every matter of fact is still possible; because it can never imply a contradiction, and is conceived by the mind with the same facility and distinctness, as if ever so conformable to reality. *That the sun will not rise to-morrow* is no less intelligible a proposition, and implies no more contradiction, than the affirmation, *that it will rise.* We should in vain, therefore, attempt to demonstrate its false-

hood!"[1] So far Hume and Kant agree. Hume is even at one with Kant in recognising the *de facto* validity of general propositions relating to matters of fact, laws of nature as we now call them. But, when we ask for the ground of this validity, Hume acknowledges himself at a loss and remains a sceptic. He can only fall back upon association, which for him is but a passive and mechanical process, devoid of reason. Kant, on the other hand, appeals directly to the unity and spontaneity of intelligence, and so gives us an explanation that is essentially teleological. Strangely enough, Hume too has recourse to teleology, as in the following remarkable passage: "It is more conformable to the ordinary wisdom of nature to secure so necessary an act of the mind [viz., that "by which we infer like effects from like causes, and *vice versa*"] by some instinct or mechanical tendency, which may be infallible in its operations, may discover itself at the first appearance of life and thought, and may be independent of all the laboured deductions of the understanding. As nature has taught us the use of our limbs, without giving us the knowledge of the muscles and nerves by which they are actuated; so has she implanted in us an instinct, which carries forward the thought in a correspondent course to that which she has established among external objects."[2] One or two remarks on this instructive passage will help us forward.

In the first place, the objection just now urged against Hume's view of association must be repeated. Associa-

[1] *Enquiry concerning Human Understanding*, § iv; *Philosophical Works*, Green and Grose's edition, vol. iv, pp. 20 ff.

[2] *Op. cit.*, p. 47.

tion is not a passive and mechanical process; even here the subject is active and selective. Not any and every 'impression' that chances is retained and reproduced, but only such as prove impressive by being interesting. Even 'at the first appearance of life and thought' we are warranted in assuming a sort of conservation that is other than mechanical. What is wholly inert and indifferent cannot learn even from nature; but 'instinctive tendency' implies more than inertia, and excludes indifference, and so cannot be purely mechanical. With this correction we may grant the instinctive beginning of experience to which Hume here refers. — But then, in the next place, it is only a beginning; it suffices, perhaps, for what Leibniz happily called *les consécutions des bêtes*.[1] And it may be true, as Leibniz goes on to say, that three-quarters of the actions of mankind are on this level, are like the practice of medical quacks or empirics, who have no theory. But the problem is to account for theory, for the remaining quarter; in a word, for the methodical inductions of science, or rather for the principle underlying them. Mere imagination, association, or custom may suffice to explain that faulty induction by simple enumeration that Bacon denounced and exposed; but what we want to understand is the source of what he called *inductio vera*. In one of his most felicitous aphorisms Bacon, by the way, gives us a hint of the true answer, which Hume's sensationalist and atomistic psychology hid from him, but which Kant's sounder psychology — and I must add, Kant's greater singleness of mind — enabled him clearly and distinctly

[1] *Monadologie*, § 28, Erdmann's edition, p. 707.

to realize. "*Qui tractaverunt scientias,*" the passage runs, "*aut empirici, aut dogmatici fuerunt. Empirici, formicæ more, congerunt tantum, et utuntur; rationales, aranearum more, telas ex se conficiunt: apis vero ratio media est, quæ materiam ex floribus horti et agri elicit; sed tamen eam propria facultate vertit et digerit.*"[1]—In the third place, even to work out his own avowedly insufficient theory, Hume has to assume the validity, both for nature and for mind, of the very conception he has failed to explain. Causal inference, he points out, is an act of the mind necessary for our preservation, because Nature has established a causal order among external objects. And this necessary act of the mind, again, is itself the *result* of natural, quasi-mechanical laws, viz., the laws of association, which obviously, therefore, cannot themselves be due to association. Causation is explained away by a psychological theory which all the while doubly presupposes it.

This brings us at length to the point, to Kant's point: we have to presuppose causality—or, more exactly, we have to presuppose law and order—before any experience can be explained, and before 'Universal Experience' can begin. We do not obtain the conceptions of natural law and natural uniformity by an antlike accumulation of particulars, nor are they mere cobwebs of the brain. Impressions do not generate these conceptions for us, but we ourselves supply them, *propria facultate,* and thereby convert and transform these crude experiences into the one 'Objective Experience' we call science. To find the ground of this rectified, systematised, universalised,

[1] *Novum Organon,* Lib. i, 95.

Experience is, we must remember, the sole problem. It is not maintained that the unassimilated experiences of the individual percipient already involve a consciousness of law, order, uniformity on his part; but simply that no mere repetition of such experience will suffice, as by a sort of *generatio æquivoca*, to bring those conceptions forth. The more frequent the repetition of impressions — interesting impressions, that is — the firmer the association, the livelier the expectation. But "why," asks Mill, "is a single instance, in some cases, sufficient for a complete induction, while in others myriads of concurring instances, without a single exception known or presumed, go such a very little way towards establishing a universal proposition? Whoever can answer this question," he truly says, "knows more of the philosophy of logic than the wisest of the ancients, and has solved the problem of induction."[1] To this weighty question Hume paid small heed; he refers to it, however, in one meagre paragraph. And there he first admits "that in some cases reflexion produces the belief without the custom"; but at once proceeds to explain away the reflexion as merely 'custom,' *i.e.* association, working "in an *oblique* and *artificial* manner."[2] But his argument, if it were as sound as it is plausible, would assuredly bring scientific induction within the range of rats and swine. For he assumes as true for the nonce the very proposition that Mill denies, viz., that myriads of concurring instances *will* suffice to establish a universal

[1] *Logic*, III, iii, *fin.*

[2] *A Treatise of Human Nature*, pt. iii, § 8, Green and Grose's edition, p. 405.

proposition; and then from such direct associations contrives to glide—'in an oblique and artificial manner'—to the principle of the uniformity of nature as also 'the effect of custom.' In fairness to Hume, however, we must not forget his scepticism. As Hamilton puts it: "Mr. Hume patronised the opinion that the notion of causality is the offspring of experience engendered upon custom. But those have a sorry insight into the philosophy of that great thinker who suppose that this was a dogmatic theory of his own. On the contrary, in his hands, it was a mere reduction of dogmatism [rather of empiricism] to absurdity by showing the inconsistency of its results."[1] Oddly enough, Mill, who raised the crucial question, *was* satisfied with the empirical answer and became 'the constructive Humist' that Hume himself was too profound a thinker to be. The net outcome, in a word, was for Hume purely negative—hence his persistent scepticism. But the negations of scepticism are often the prelude to positive advance; and in this instance Hume deserved the high commendations Kant repeatedly accorded to him as his own and only forerunner.

Kant's question, generally stated, was as to the epistemological character of the conception of Nature as a system of laws. Up to Hume's time but two alternatives were entertained, and he clearly negatives both. The necessity implied in natural law is not discoverable by the mere operation of thought. Comparison of ideas can only reveal agreement or difference; formal logic is essentially analytical. This necessity then is not *logical.*

[1] *Lectures on Metaphysics*, vol. ii, p. 394.

Nor again is it *empirical;* for it is not given itself as matter of fact, neither is it given in the temporal or spatial continuity of matters of fact. And yet this conception of causal necessity, and, more generally, the conception of Nature as a single orderly system, unquestionably exists. This it must be remembered Hume never denies; and so, as he is clear that the origin of this conception is not 'objective,' as we say nowadays, he concludes that it must be subjective. But the only subjective source he can find is association, and this will not suffice. With all this Kant agrees. But he takes a wider and deeper view of human nature than Hume could do; and so a subjective possibility is open to him, which Hume's psychology had foreclosed. According to that "the human mind is [but] a system of different perceptions or different existences, which are linked together by the relation of cause and effect, and mutually produce, destroy, influence, and modify each other."[1] Such was his account of it in the *Treatise.* No wonder then that in an appendix to later editions he confesses: "But all my hopes vanish, when I come to explain the principles that unite our successive perceptions in our thought or consciousness. I cannot discover any theory which gives me satisfaction on this head."[2] This principle that Hume cannot find is, of course, Kant's 'originally synthetic unity of apperception.' We have already had to discuss the meaning and import of this principle in examining dualism. But we come upon it

[1] *A Treatise of Human Nature,* vol. i, p. 541 *fin.*

[2] Cf. the like admission of Mill, *Examination of Sir W. Hamilton's Philosophy,* ch. xii, *fin.*

in a new light here, where it presents itself as the source of the conception of Nature as a system of unity and law. Reserving this point for the next lecture, let us note, in conclusion, the result we have attained so far.

We are inquiring into the possibility of advancing from neutral or agnostic monism to a monism of an idealistic or spiritualistic type. We have seen Huxley, the scientific champion of agnosticism, run his ship high and dry on the idealistic side and there capitulate: "Our one certainty," he acknowledges, "is the existence of the mental world." We have, too, his admission that the conception of universal and necessary laws is ideal, an invention of the mind's own devising, not a physical fact. Lastly, we have found his forerunner and master in philosophy, David Hume, proving that this notion of universal and necessary law holding among matters of fact is neither empirically given nor logically deducible; and further, that it is psychologically inexplicable to those who deny that 'there is a spirit in man,' an active, unifying principle, the ground of self-consciousness and self-determination. In brief, taking agnostic naturalism just as it presents itself, we have found it to be really inside out. Instead of the physical world being primary and fundamental, the mental world secondary and episodic, as it supposes, the precise opposite is implicit in its own very structure. The things known, material permanence, mechanical necessity, natural law, will not account for the knower: can we find anything in the knower that will account for them, is now the question. If we do, it must be something teleological.

Already we know that man's knowledge of nature has been acquired by the sweat of his brow, as truly as any other product of civilisation; how far the organon and methods of this process and the result itself are teleological we shall do well to consider further.

LECTURE XIX

NATURE AS TELEOLOGICAL

The fact of self-activity, at once volitional and intellectual, bears upon the conception of Nature in three ways; as regards its unity, its causality, its regularity.

The Unity *of Nature is the ideal counterpart of the actual unity of each individual experience. Experience itself is unifying, and beyond this immanence of experience we cannot go.*

Causality, *and the principle of causal uniformity or regularity distinguished. In discussing the former we may note three divisions of experience: (a) that of intersubjective intercourse and coöperation; (b) that of the individual and his immediate environment; (c) that of science, in which objective changes are regarded solely in relation to each other. In (a) activity and passivity are* primâ facie *certain. So in (b) as far as the subject, but not the object, is concerned. In (c) causality is only analogically assumed. Science disallows, or rather dispenses with, the analogy. In the scientific ideal individual things and definite acts have no abiding place. This position at once subordinates Nature to Mind.*

Some supposed difficulties besetting the conception of subjective activity discussed: the fact of such activity remains.

As regards Regularity *— the conception of natural law rests on the analogy of civil law. Both are contingent on the realisation of certain necessary conditions. Universal and necessary knowledge of Nature presupposes thought: here the conditions are in us and are necessary: the result is contingent on things conforming.*

If they do conform, we are entitled to say (1) that Nature itself is in this respect teleological, and (2) teleological further in being consequently amenable to human ends. As it is solely by our activity that this assimilation of Nature is achieved, the result may be described as that greeting of spirit by spirit which idealism has always maintained.

NATURE, as science regards it, may be described as a system, whose parts, be they simple, be they complex, are wholly determined by universal laws. Knowledge of these laws is an indispensable means to that subjugation and control of Nature, upon which human welfare and advance in large measure depend. So far the pursuit and acquisition of such knowledge is teleological, as truly so as other practical pursuits and achievements of human activity. But what of the conception itself of this systematic unity and invariable conformity to law? That too, I say, is teleological, is a means to the end, Knowledge itself. It is of the nature of a hypothesis or postulate, and differs from other hypotheses or postulates relating to objective reality only in the fact that it underlies them all. But it is not an axiom, which it would be absurd to deny; it is not in itself self-evident, nor is it a deduction from anything self-evident. Nor again is it so much brute fact thrust upon us willy-nilly. Experiences of a sort are possible without it; and purely formal knowledge, such as logic and arithmetic, is independent of it. In neither of these senses then is it objective. So far is this from being the case, that we can, as Kant has remarked, perfectly well imagine the variety and diversity among things to be so bewildering, as to set our powers of classification and simplification at defiance, and render any systematisation of experience impossible.[1] And as it is, the amount of empirical material actually assimilated and reduced to law is small compared with the vast amount that still remains more or less crude and intractable. Moreover, the range of

[1] Cf. *Kritik der Urtheilskraft*, Einleitung, § v.

our experience in space and time is infinitesimal compared with the extent and duration of the universe; and Stuart Mill accordingly, as is well known, declared it to be folly to affirm confidently that the law of causation is a law of the universe and prevails even in distant stellar regions. But on such a view we have no longer law but only probability, and objectively, *i.e.* so far as the universe goes, only indefinitely slight probability, as Mill himself expressly allows. Yet, quite strictly speaking, we ought not to talk even of probability, inasmuch as any working theory of probability presupposes law and uniformity. The conception of Nature then, as a system of laws, is, we must say, hypothetical; since it is not self-evident, but admits of question and awaits verification. But it is an indispensable hypothesis, or postulate; for without it scientific experience is impossible. The *ideal* of science is complete prescience, thoroughgoing explication; but comparison, observation, experiment, reasoning, in a word intellectual activity on our part, is an essential to its realisation; and the conception of the universe as a realm of law is the only assumption that can save us from wasting our labour.

But how do we know this? Why *must* we assume that Nature is a connected system of uniform laws, and whence do we derive such a conception? The answer to these questions is to be found in what we are ourselves — self-conscious, self-determining individuals. And this answer is at once simple and profound. It brings us back, as we saw in the last lecture, to Kant's 'originally synthetic unity of apperception' as "the highest point

from which all use of the understanding depends" — the principle which Hume sought for, but could not find. It behoved him to seek it, for he admitted that our successive perceptions are united in one consciousness; but he could not find it, because perceptions were for him but 'distinct existences' and "no connexions," he maintained, "among distinct existences are ever discoverable by human understanding."[1] But this means approaching experience from the wrong side; and it means also ignoring everything in experience except the several 'impressions' of sense — both oversights which we commonly find in naturalistic psychology. The convergence of radii towards a centre might seem puzzling if we set out by regarding them as merely so many distinct lines, though plain enough to one who saw them proceed from this centre itself. Such precisely are the respective positions towards the whole problem of experience and knowledge of Hume and Naturalism on the one hand, of Kant and Spiritualism on the other. True, says Kant, almost repeating Hume's words, "no connexion can ever come to us through the medium of sense. . . . Connexion (conjunctio) is a spontaneous act of consciousness, *i.e.* of intellect, . . . as distinguished from sense. . . . This act we may call by the general name of *synthesis* in order to signalise (1) the fact that we can be aware of nothing as conjoined in the object unless we have previously ourselves conjoined it, and (2) the fact that, among all our presentations, '*connexion*' is the only one that cannot be given by the object, but must be wrought solely by the subject itself, since it is an act of its own

[1] *Treatise*, vol. i, App., p. 559.

self-activity."[1] But this self-activity of the subject is not merely intellective or apperceptive; it is also — and I think we must add, it is primarily — a practical or conative activity. However much for purposes of exposition we may abstract, we cannot separate, intellection from volition. This is a truth of fundamental importance, but I have insisted upon it at length in earlier lectures and it is sufficient here to recall it. With this supplement, then, the fact of self-activity, at once volitional and intellectual, bears upon the conception of Nature in three ways — as regards its unity, as regards its causality, and as regards its regularity. Let us consider each of these in turn.

The Unity of Nature is the ideal counterpart of the actual unity of each individual experience — an ideal towards which we first advance when intersubjective intercourse and reasoning begin; and an ideal which becomes clearer and more distinct as mythology gives place to science, and, I will venture to add, as science in turn is taken up into philosophy. But it is unnecessary at this stage of our argument to enlarge upon the monistic character of experience; this we have done already with sufficient detail in discussing dualism. The one point that now concerns us is the possibility of interpreting this monism idealistically, that is to say as a spiritualism; and in this connexion the fact that all that is formative in experience is primarily due to subjective activity is of fundamental importance. However elementary or however advanced this formative process may be, the one activity complexly expressed as 'I

[1] *Analytik*, § 15.

think, I feel, I do' is implied throughout, connecting all that is presented or presentable with the one subjective centre. Things *per se*, if we could properly talk of them, might be called distinct and separate existences; for as it is certain that they are nothing *for me*, they may quite well be nothing for each other. But in so far as Nature and *possible* experience are one and the same, what holds of possible experience will hold of Nature, because it holds of experience.[1] But the subject of experience is, in one sense, always egoistic, never disinterested; for it is only because certain perceptions are my perceptions that they are perceptions at all; and in being my perceptions they have necessarily that unity which I certainly cannot get from them, and certainly do give to them. Moreover, that intellective or selective synthesis by which I make them *mine* — though I do not make them absolutely — is determined primarily by an affinity of interest, not by an affinity of 'content,' is a function of life first, not of logic. It is in this sense that we must understand Kant's bold paradox, that the intellect makes Nature, though it does not create it. It organises, but it does not originate; just as it organises, but does not originate, the sense-particulars of experience. The very first result of this process is unity; nay, experience itself is this unifying, and beyond that we cannot go. The immanence of experience is thus absolute, and it is on this ground that we say all phenomena exist in one Nature, in complete community, in one continuous space and one continuous time. We can treat such phenomena as distinct and separable relatively

[1] Cf. Kant's *Prolegomena*, § 36.

to each other, but only provided they are apperceived and thereby made constituent parts of one organic unity. Hence Kant was careful to distinguish this original, qualitative unity, as he called it, of apperception from quantitative unity as a category, which, like all categories, is derived from it.

Of these categories that of Causality is the chief; and here, as I said just now, we have to emphasise the practical side of subjective activity, which Kant in his first *Critique* leaves out of account. For this reason it is desirable to consider the source of the notion of Cause and its bearing on that of Nature prior to any discussion of Law or Regularity. Causal *laws*, no doubt, are what man is mainly concerned to know, for only so far as Nature is regular in *her* action there can then be either method or purpose in ours. On the other hand, if we were simply passive, impotent to act and counteract, science would be for us no better than a gypsy fortune-teller, and knowledge would certainly not be power. Further, unless we have some concrete experience of what causation is, it seems obvious that universal laws of causation will be universal laws simply; to call them causal laws will be meaningless. But they are not simply universal laws, since their universality depends neither on laws of thought nor on pure intuition, is neither logical nor mathematical. They relate to matters of fact. We ask then for instances, and the familiar cases of sun shining and wax softening, or clay hardening, are cited. Such perceptions become causal judgments, we are told, when it is affirmed that the sun melts the wax and bakes the clay. But we may demur

to such instances. So far as the relations of the one object to the other go, they afford us no direct experience of either cause or effect: in these relations there is nothing, as Hume truly urged, but spatial and temporal proximity of sunshine and melting wax, sunshine and hardening clay. And assuredly there is nothing in the bare form of the hypothetical judgment to warrant the addition to those perceptions of the notions of activity and passivity. Yet just as surely those notions are involved in the affirmations — the sunshine melts the wax, the wax is melted by the sunshine. But how have they got there? Is it verily a case of solar myth? Precisely so, we have heard the naturalist reply: the notion of Cause like that of Substance is a fetish, and both these items of anthropomorphic superstition we eliminate. Yes, from science perhaps, but certainly not from experience. Activity and passivity, doing and undergoing, are at least *prima facie* facts of experience, connecting subjective change with objective change, and objective change with subjective change. It is *prima facie* certain that, within limits, I determine the course of external things, and that this within limits determines me. Such immediate experience of activity and passivity may be the *source* of myth, but at least it is not itself mythical. In analogy we infer a second similarity only from a first that is given independently: we cannot advance by rule of three to a second ratio save as we are sure of a first. It is not then in the relation of one objective change to another that we first find causation; that is rather where we put it, in order intellectually to assimilate or synthesise. Kant, it will be remembered, applies the notion

of analogy both to the category of substance and to that of cause; but with him in the latter case the prime relation is that of reason and consequent in logic, the analogical relation that of cause and effect in time. But in all this, I repeat, Kant is thinking only of the universality of causal laws, not at all of the specific character of the causal relation itself, as manifested in each single instance in which it occurs. As regards this character in concrete instances, our procedure is truly analogical. The activity and passivity that are, at least *prima facie*, facts of individual experience, constituting what we call the interaction of subject and environment, we transfer by parity of reasoning to what we regard as the interaction of object and object in universal experience. Such inference, of course, hangs together with that other analogy by which we regard such objects as things or individuals. Both analogies are facilitated by intersubjective intercourse; for, unless we are content to be solipsists, we are forced to regard our fellow-creatures as individual agents interacting with us, and interacting, like ourselves, with their environment.

From the point of view of our present discussion, then, we may make a threefold division of experience. We have first this experience of intersubjective intercourse. This yields a complete knowledge of what is, *prima facie*, causal efficacy. I know that my fellow-man is determined or influenced by my action, as I, in turn, am determined or influenced by his. Society, civilisation, and science itself are the result of such interaction. It may be that such communion and reciprocity is not direct, but takes place through the medium and instrumentality of 'matter.'

But a medium or instrument is not necessarily either an agent or a patient. It may be perfect just in proportion as it is itself *inert*, neither increasing nor diminishing nor in any way modifying what is transmitted or effected through it. So regarded, the material world occupies an entirely secondary and subservient position; and in describing it as a mechanism we, in fact, only emphasise this, for what is a machine but an artificial means or contrivance to minister to doing?

We have next the experience of the individual subject dealing with the physical environment simply. There is here no evidence of *inter*action, such as we have where there is coöperation or conflict of man with his fellows. I only know that a certain change in the environment answers to my voluntary doing or activity, and a certain other change again to my involuntary doing or passivity. But I cannot perceive that, in the cases in which I act, my environment suffers, nor *vice versa*; if I infer these, I do so by assimilating the physical environment to myself or to the social environment, as primitive man does when he personifies sun and moon, winds and streams, fire and pestilence.

Lastly, we have the universal experience of science, in which objective changes are regarded solely in relation to each other. Here there is no direct evidence of action at all: the changes alone are directly discernible. The repeated coexistences and successions we observe among these objects confirm the anthropomorphic interpretation of them as individual things interacting after the analogy of subjects. But in reality we discover nothing but recurring conjunctions of qualities and recurring

sequences of events. Moreover, the analogy which would lead us to treat such objects as individuals would require us further to assume a medium for their interaction. The environing medium of such hypothetical subjects, too, can, of course, be again resolved into hypothetical subjects of a lower order interacting in an outstanding medium, and so on indefinitely. In point of fact, common thought and language never relinquish this intersubjective analogy so long as they refer to changes as definite at all. Scientific thought, on the other hand, strenuously disavows it; though implications of it still linger in the language of science till that takes the form of equations. Meanwhile, science devises methods and elaborates conceptions, by which to resolve those variegated uniformities of coexistence and succession, from which it sets out, into one continuous and unchangeable content in space and one continuous and unalterable process in time. But neither space nor matter, neither time nor motion, affords any place for causal activity in the only form of it of which we have any immediate knowledge. Hence it behoves us to realise, what most expositions of causation ignore or deny — I mean, that causation and causal uniformity are entirely distinct. An efficient cause is not necessarily uniform in its action, and uniformity of sequence does not directly imply such causal intervention.

Within the scientific scheme, then, individual things and definite acts find no abiding-place. The whole is one thing and the procession of its changes one continuous event. Such is Nature, and the course of Nature as Naturalism conceives it. But, from the way in which we have come upon this conception, we see clearly that effi-

cient causes are not in strictness eliminated from it: the strict truth is rather that they never enter into it. There is nothing in it, therefore, that can possibly discredit that *prima facie* interaction of individual minds, of which the whole social fabric is a proof. Nor, again, is there anything that can possibly discredit that *rapport*, alternately predominantly passive and predominantly active, of each individual subject with its own environment, on which in turn intersubjective intercourse and combination depend. Such a conception of Nature, I say, cannot possibly discredit these divisions of experience; for, in the first place, it leaves them entirely aside. The conception of efficient cause lies beyond its bounds: it recognises law, orderly sequence of events; but it neither asserts nor denies what we know as activity and passivity. And in the next place, the conception of Nature, so limited, cannot discredit our experience of activity and passivity, for the very existence of this conception presupposes both; first, inasmuch as it is but a formula or descriptive scheme, summarising a common objective factor of universal experience; and further inasmuch as, in being a formula or scheme at all, it *is* primarily — whatever validity it may have — but an ideal intellectually elaborated. And plainly, as we have seen, objects without subjects are nonsense, intellectual constructions without intellect impossible, and intellect without synthetic activity a nonentity.

Nevertheless I have spoken of all subjective activity only as *prima facie* such. I did so, because this at least is allowed generally and is sufficient to discriminate experience in the concrete from the abstract scheme of science; and because, further, it was desirable to

avoid any semblance of dogmatism. Still we must admit that, if the reality of such activity can be effectually challenged, there is an end of spiritualistic monism. But our discussion shews, I think, that at any rate this reality cannot be impugned from the side of the natural sciences. They can only say we do not find it, and could make nothing of it if we did: it does not belong to us. Beside this negative answer we have placed the indirect argument, that the existence of the sciences themselves becomes inexplicable, if the search for truth, the refutation of error, the labours of observation, experiment, and computation, were themselves part and parcel of the one course of Nature within which, it is said, no spontaneity is found. The hopeless inconsistencies of such a position were exposed in our earlier examination of the conscious automaton theory; and its actual inversion of the true place of science in experience we have now seen.

The only ground for misgiving lies in the alleged inconceivability of subjective activity. Unquestionably there is a bewildering diversity of opinion among psychologists on this point, which we cannot now even attempt to unravel. But, happily, it is not a question of conceivability, but of fact. The conceiving of a very simple fact may be in itself a very complex process: indeed one might very plausibly maintain that such an inverse relation is rather the rule than the exception; that generally most intellectual work is involved in the satisfactory determination and definition of the most elementary facts, and accordingly that it is only as we advance farther synthetically that we can regress farther analyti-

cally. Thus the psychologists know better what they mean by perception than what they mean by sensation; and the physicist is clearer about metals than he is about matter.

But I would urge that we need not merely to distinguish between activity and the conception of activity, but to distinguish also between activity and the perception of it. When we talk of perceiving that we are active we really imply introspection, even perhaps retrospection: in a word, we are at the level of self-consciousness or reflective consciousness; and I presume no one will maintain that consciousness begins, or always remains, at this level. Many of those who complain that activity is inconceivable, shew by their arguments that what they look for is the details of how it is done. Like the distracted centipede in the fable, puzzling how it ran, they ask, What exactly do I do when I do? How can I set about doing, unless I know how? How can I be active, if the content and conditions of activity are not clear to me? Thus Mr. Bradley asks, "What is the content of activity as it appears to the soul at first?"[1] * He promises also to be duly grateful to any one who will direct him 'to an experimental inquiry' into its particular conditions! — We are of course continually endeavouring to make apparently simple processes of so-called transeunt action distinct, by resolving them into complex processes that involve conspiring circumstances and intermediate links. To imagine any such method applicable to subjective activity is to assimilate mental action to so-called physical action, the

[1] *Appearance and Reality*, 2nd ed. pp. 604 f. * See Note i, p. 612

known to the unknown, the primitive to the derivative, the fact to the fiction. And as the continuity of space and time, because it allows, nay compels, an indefinite regress, prevents the physicist's inquiry from ever terminating, so the like failure for like reasons is sure to befall the experimental inquiries of psychologists who set out by regarding activity as an 'appearance,' the conditions of which are to be found among other 'appearances.' It is not surprising, therefore, that those who have adopted such methods soon confidently assert that conscious activity is an illusion, due to certain combinations and successions of sensations.[1] And so is reached that thoroughgoing naturalistic phenomenalism or agnostic nihilism, which in completing itself refutes itself.

The relation of subject and object is not only for experience an indissoluble relation, but it is an incommutable one. We cannot treat the subjective as we do the objective and form an abstract scheme, a statics and dynamics, of spirit in Herbartian fashion. Activity is of the essence of the relation though it does not make it, and — giving the wide meaning to apperception that is nowadays sometimes given to it — we may say with Kant that among all our presentations this is "the only one that cannot be given by the object, but must be wrought solely by the subject itself, since it is an act of its own self-activity." If we ask for the conditions of this activity, we must transcend experience to get them. There would be little point in saying that the subject is a condition, for it only *is*, as it is active; nor that

[1] Cf. my paper, '*Modern*' *Psychology*, *Mind*, 1893, N.S., vol. ii, pp. 75 ff.

objects are a condition, for they again only are verily objects, as they are apperceived. As Lotze very pertinently observes: "We cannot go on indefinitely requiring intermediary machinery . . . at some point or other the chain of intermediaries must consist of simple members connected together *immediately* and not requiring something else to hold them together. . . . All attempts to explain still further these most simple elements of action and recurrence, to elucidate them by shewing the way in which they come to pass, must invariably fail; but they fail not on account of the imperfection of our knowledge, but because the very existence of what they erroneously seek is impossible."[1] This immediacy, it seems to me, we have in experience, in the activity of cognition and volition. Strangely enough, those who have such compunction about admitting mental activity regard mental passivity as transparent fact; and yet a very little reflexion might convince them that passivity involves activity. The scientific scheme accordingly, which eliminates activity, equally eliminates passivity, or more exactly — as we have just seen — the one conception enters into it as little as the other. Inertia means not merely inactivity, but also impassivity. A body, as the physicist regards it, can do nothing and can suffer nothing. The changes, which at first we say it undergoes, resolve into motions of the aggregate of which we say it consists; and such resolution has no assignable limit short of points in space and instants in time. Changes within a body, defined by its qualities, eventually become changes between punctual something-

[1] *Microcosmus*, Eng. trans., vol. ii, p. 620.

nesses defined only by quantity. These physical points themselves, again, are strictly indifferent, devoid alike of faculty and of capacity, neither endeavouring to change nor resisting change, but incapable of it. And now *per contra*, it must be urged that we who *experience* change are parties to it, indifferent only to the uninteresting, surprised by the unexpected, but attentive to all that can hinder or help, feeling constraint only because conscious of freedom and bent on progress.*

As regards Causality then, as we understand it in our own immediate experience and in all human affairs, we find it indeed excluded from the scientific realm of Nature, but not thereby attainted or even impeached in its native domain. That Naturalism nevertheless should regard the whole notion of efficiency as extirpated, root and branch, is but a consequence of the unwarrantable assumption that the realm of Nature is primary, independent, and complete in itself. But the truth, I trust, is becoming ever clearer to us that such a phenomenal world *per se* is a hopeless contradiction, that Nature, as we come to conceive it, is neither primary nor independent and complete in itself; that our conception of it is merely an abstract scheme; and that, as such, it necessarily presupposes intellectual constructiveness, and motives to sustain the labour that such construction entails. Epistemological inquiries, in a word, completely reverse the situation, which Naturalism, without condescending to such inquiries, simply takes for granted. Mind is not the impotent shadow of Nature as thus shaped forth, but this shaping is itself the work of mind. At this point many questions present themselves which might

* See Note ii, p. 612.

tempt us at once to press our advantage over Naturalism. But it will be really wiser to defer them till we have examined this shaping process itself. This constitutes the last of my three points — the *regularity* of Nature as postulated by mind.

A glance at the history of science, more particularly at the development of those sciences which have advanced the farthest towards the scientific ideal, would disclose a curious inversion in the positions occupied by the notions of cause and of law. The more substantial causes fall out of sight, the more universal laws take on their *rôle;* and, presently, they become hypostatized as 'self-existent laws'; they operate unchecked, they reign supreme, 'binding nature fast in fate.' Nevertheless by this substitution science supposes that human experience emerges from the anthropomorphic or mythical dawn with its metaphysical shadows, and enters the clear noonday of positive Knowledge. "Fact I know, and Law I know," says Huxley. I have now to urge that this jubilation is premature, that we do *not* know Law, in the sense in which we know fact. If we do not find causes among our facts, so neither do we find laws among them; if the conception of active causes is anthropomorphic, so equally is that of universal laws. At the level of individual experience we may perceive facts, but we do not as yet conceive of laws that determine them. This conception is the outcome of intersubjective intercourse, of social coöperation; for society is impossible without some government, and is more perfect, the more law and order are assured and stable. Now we know that pre-scientific man assumed the

prevalence of a divine law and order in Nature analogous to that existing among men. We know, too, that this assumption was at least the origin of the conception of scientific law. Such an assumption may be called natural superstition, religious credulity, or spiritual instinct; but at least it is neither incontestable fact nor logical necessity. How far is the final conception of scientific law of a different character?

Though the human mind, human society, and human knowledge have developed continuously and *pari passu*, yet we can deal with this question most effectively from the reflective standpoint taken by Kant; that is by assuming the human mind to be what it now is, and real knowledge still to be acquired. We then ask how is such real knowledge — universal, scientific experience — possible? So, assuming the individual mind to be what it now is and society still waiting to be founded, we may ask how is society possible? The answers to these questions are strikingly alike, though that to the last be the more obvious of the two. We read that after the flood "the whole earth was of one language and of one speech . . . and they said one to another, Go to, let us make brick and . . . let us build us a city and a tower. . . . And the Lord said, Behold they are one people and they have one language; and this is what they begin to do: and now nothing will be withholden from them, which they purpose to do. Go to, let us go down and there confound their language, that they may not understand one another's speech. . . . So they left off to build the city." Here the conditions of the possibility of society are clearly implied; when a common under-

standing and a common purpose exist, society is possible, when they cease, any existing society is at an end. It is not enough that each man has understanding and purpose, but there must be common understanding and common purpose before there can be one people. A like accord between thinking and being is the condition without which knowledge is impossible. Knowledge no doubt is thought before everything; but it is also more; thought is not directly knowledge, but only indirectly, *i.e.*, — as Kant says in one bold passage, — "by referring to something purely contingent, namely *possible experience*."[1] By possible experience here we are to understand the scientific ideal of orderly and systematic knowledge, in which every item has its place in virtue of universal and necessary laws. Such an ideal in itself is 'something purely contingent': it may prove to be valid and it may cease to be so. But the *conditions* of this possibility are epistemologically not contingent but necessary. In this sense our ideal is hypothetical: it is a consequent of the conditions. Now *those conditions are in us,* who know, not in the things to be known. Will the things conform, will they be intelligible? As with the social compact, we can only trust and try; it must be this way, if at all: the conditions are necessary, actual realisation is contingent; in this wise the whole notion of universal and necessary laws of Nature is, then, essentially a postulate. To quote Kant again: "It is not a dogma . . . because it has this peculiarity that it first renders its own proof, viz., experience, possible; and has always to be presupposed for the sake of experience."

[1] *Kritik der reinen Vernunft,* 1te Aus., p. 737.

Man may be very helpless, but at least he makes this demand, and looks to its fulfilment to give him prescience and power. And it has been fulfilled, and he has power and prescience accordingly. Nevertheless, passing strange though it be, those who have done most to achieve this result would fain persuade us that it is no achievement, and that man is as powerless over against the Nature whose laws he conceives, as wax under the stamp by which it is impressed. It is against this view that I urge the analogy between civil law and natural law, and the certain fact that the conception of the latter is derived from the former. If man had never made laws he could never know law, and if he were not a free agent he could neither make laws nor obey them. How absurd it would be to argue, that in constituting a commonwealth in order to obtain greater freedom and security, men thereby become slaves, because as citizens they can no longer each one do whatever is right in his own eyes. Equally absurd is it to argue that, in postulating regularity in Nature as the one ground of rational experience, we are deprived of all power and initiative, because in a system of universal and necessary law nothing can be arbitrary and there can be no gaps. If the conception of mechanism enables us to summarise details that would otherwise bewilder us, this cannot possibly nullify our independence, reduce *us* to parts of the machine, and elevate *that* into an absolute fate. The very fact that it is our conception, that we devised it and use it, see its imperfections and amend them, shews that we are outside it and above it: its *a priori* condition and not its helpless consequence. In a word, con-

cisely to express the scope of that regularity which science postulates, we must say as Kant has done,[1] not only *In mundo non datur casus*, but also *In mundo non datur fatum.* Nothing happens by blind chance, and also nothing happens by blind necessity. The necessity of natural law is always 'a conditional, and consequently intelligible, necessity.' Moreover, this intelligible, or hypothetical, necessity, as Kant also calls it, applies — as he is careful to point out — not to the existence of things, but only to their relations, which obviously presuppose them. In jural affairs—the source, we must ever remember, of this analogy of natural regularity — we might say whatever happens is determined by law so far as there is either conformity to statute or submission to penalty. But here, where law has its strict meaning, we are aware that it would be nonsense to talk of it as self-existent or self-executive. "Just as impossible is it to assume," borrowing the words of Lotze, "that first there could be as absolute *Prius*, a kingdom of forms necessary in themselves, a sort of immemorial Fate; and then that there should afterwards be, however created, a world subjected to the constraint of these laws in order to give reality to just whatever their limitations might permit. Rather it is the real alone that is and through its being produces the semblance of a necessity preceding it, much as the living body shapes within itself the skeleton, round about which it seems to have grown."[2]

Let me now try to gather up in a sentence or two the results up to this point of our discussion of Natural

[1] Cf. the concluding remarks on the third Postulate of Experience.

[2] *Metaphysik*, 1879, § 88 *fin.*

Law, so far, at least, as is necessary to make clear the next step in our argument. That argument is that the material and mechanical are not fundamental, but that the teleological and spiritual underlie them and are presupposed by them. So far we have mainly considered the process, and analysed the conception, of natural knowledge. We have seen that the process is teleological in its origin, since it is prompted and sustained by practical motives. Also that the conception of natural law is teleological in its character, first inasmuch as it is hypothetical, and every hypothesis a means to an end, a theoretical organon that may or may not work; secondly and more especially, inasmuch as the hypothesis is that Nature will conform to the conditions of our intelligence. It has been needful to exhibit at length, and to emphasise, the fact that these conditions do emanate from us; needful to explain and maintain the daring position of Kant that the intellect makes Nature, though it does not create it. We have traced to this source the attribution of unity and regularity to Nature; and we have seen that the causal efficiency, with which positive science can dispense, so long as it merely describes and computes, remains, and remains necessarily, the unassailable possession of Mind. Of course, let me parenthetically observe, the standpoint of our discussion has been that of the duality of subject and object and implies only such independence as that duality involves: the disparateness of dualism with its mind *per se* and matter *per se* we claim to have transcended. We have then this result: It being in general granted that our con-

ception of the unity and regularity of Nature is entitled to the name of knowledge — being ever confirmed, never falsified, by experience — we are now equally entitled to say that this unity and regularity of Nature proves that *Nature itself* is teleological, and *that* in two respects: (1) it is conformable to human intelligence and (2), in consequence, it is amenable to human ends. Such is the new step in our argument, and it contains all that is essential to complete it.

A word or two may, I trust, suffice to make its bearing clear. In the first point mentioned we find implied that essential oneness of thought and being, that recognition of the intelligible by intelligence, that greeting of spirit by spirit, for which idealists have always contended. I do not propose to dilate upon this; it is more germane to the discussion I must soon bring to a close to insist still upon what is essential to every true idealism or spiritualism, — the spontaneous activity of the greeting intelligence. This granted, the rest soon follows; while by ignoring this first and denying it finally, Naturalism has brought upon us 'that nightmare of advancing tide of matter and tightening grasp of law,' which Agnosticism is helpless to dispel. Of the bare relation of subject and object as common to all forms and phases of experience nothing can be said; by no means can we ever get behind this; indeed, strictly speaking, we can never get so far back. We cannot know experience as absolutely beginning but only as in process, and here subjective spontaneity as selecting and connecting at once asserts itself. If we try to conceive an objective process apart from this, we picture a kaleidoscopic

succession of numberless elements in numberless combinations but devoid of any fixity, any connexion, or any progress. The more clearly we succeed in mentally depicting such 'mind-stuff' or 'matter-stuff' in its nakedness,—it is indifferent which we call it,—the more hopeless and absurd will appear the emergence therefrom of a living, feeling Ego and a known non-Ego; albeit such a *generatio æquivoca* of experience is all that Naturalism can logically offer us. If, as Kant does, we regard experience as starting with such an indefinite manifold as its objective complement, we must hasten to add, that the start is only made when this matter of experience is shaped and informed by the subject conscious of it and interested in it. Now the point on which I have to insist is this: not only is subjective synthesis indispensable before experience can really begin; but it is only by means of this synthesis, and the conative activity by which it is prompted and sustained, that experience can advance and unfold. No doubt in all such advance there is a constant reciprocity, if I may so say, between subject and object. But my contention is that to the subject belongs the lead and initiative throughout, and that, as experience developes, this subject shews an ever increasing activity and supremacy. Association is freer than sensation and entails more voluntary effort; thought is freer than both, entailing more voluntary effort still. Things need not conform to our thinking, as the existence of error shews: when they do conform—however this is brought about—we call them intelligible, describe them as, in content or essence, ideal.

No doubt truth is reached by a series of approximations, but to find it we must seek it, and the main clue is our own nature. A rude anthropomorphism gives us our first bearings, and every advance in knowledge of the Not-self is a further self-revealing. With this clearer self-consciousness we judge the world more adequately, employ truer and more perfect categories. But all through it is a process of assimilating the non-Ego to the Ego, not the Ego to the non-Ego; and therefore self-realisation is the sole way to advance. The most potent of all means of self-realisation is human society; "as iron sharpeneth iron so the countenance of man his fellow." Here first we transcend the narrow limits of individual experience, confined to perception, reminiscence, and expectation. Discourse makes us logical; we ask questions, need convincing, and so we reason; for universal experience consists from the first wholly of thoughts, as it necessarily must, since only thoughts admit of communication. But all constructive thinking, if we consider its content and not merely its form, consists in assimilating. "The resolution of mystery," as Dr. Bain has somewhere said, "is found in assimilation, identity, fraternity." The ultimate paradigm, if I may so say, for this process we have in our own self-consciousness, or rather in what we find common to all our self-consciousnesses and call reason. This is the truth embodied in Kant's transcendental unity of apperception. It is shadowed forth, however perverted by its author, in the *Homo mensura* doctrine of Protagoras, and in the saying of Aristotle τὸ ὅμοιον τῷ ὁμοίῳ γιγνώσκεσθαι;

indeed in one form or other it is a truth everywhere apparent in the course of philosophy. In a sense, then, we are always anthropomorphic. According to Naturalism the myths and cosmogonies of early thought are purely subjective, while the laws of Nature that refute them are wholly objective. But there is no such chasm between them. In Baconian language both are an *anticipatio mentis* and both are an *interpretatio Naturæ.* It is solely through obstinate questionings of reason, strengthened and clarified by the effort, that the truer interpretation has been reached; and its success, so far from justifying any dualism of subjective and objective, should only assure an unbiassed and reflective mind that Nature and Man are one in being rational.

LECTURE XX

SPIRITUALISTIC MONISM

Laws of Nature used in two senses: (a) as implying substantial causes; (b) as implying only constant relations. Does the substitution of the latter for the former enable positive science to clear itself of all anthropomorphic taint? No, for (1) its method and assumptions prove it to be a human instrument; (2) it shows that things are ordered by measure and number, but not what they are themselves. Subjects with intrinsic qualities, and causally efficient, are facts of experience prior to and independent of it. It must come to terms with these when challenged. We say then: Either it is itself intelligent or there is intelligence beyond it. Either it is itself causally efficient or there is a causal agent behind it. But for an answer to these questions Naturalism refers us to Agnosticism. And Agnosticism again betrays it.

Mr. Herbert Spencer's answer examined. A First Cause is "a necessary datum of consciousness, but cannot in any manner or degree be known in the strict sense of knowing." Nevertheless, his Unknowable turns out to be "the same Power which in ourselves wells up under the form of consciousness."

What Mr. Spencer means by 'knowing in the strict sense.' The Kantian distinction of determinant, and reflective, judgment brought to bear.

The agnostic use of 'Phenomenon' criticised. Appearances do not veil reality.

As a further objection to a spiritualistic interpretation of Nature, it is said that there can be no mind behind it, for it is never interfered with. This objection due to a confusion easily exposed.

Moreover, when we divest ourselves of the scientific bias, and contemplate the world in its historical concreteness, we can see the true reality to be not a mechanism but a Realm of Ends.

NATURALISM takes for granted, as we have seen, that, when it has substituted for the conception of causal agents that of universal laws, it has cleared itself of the anthropomorphic taint, in other words of all spiritual implications, and become pure positive, objective, science. That the conception of law is primarily and properly a jural conception, implying a sovereign power, cannot be denied, nor yet that in its first application to Nature a Divine Lawgiver was everywhere and always assumed. But all this, of course, is anthropomorphic. In the last lecture the question was raised whether the scientific form of this conception is essentially of a different character; in the course of a general discussion of the nature of knowledge, it was answered in the negative. I propose now to return to this question and to deal with it in a more special way.

We find laws of Nature used in two very different senses by scientific writers. Sometimes such laws are spoken of as self-existent and as independent of the phenomena which they are said to govern and which of necessity conform to them. But this language is only defensible on one of two suppositions: either the so-called self-existent laws are themselves causal agents and phenomena the result of their interaction; or by a metonymy, such as we commonly employ in speaking of civil law, the laws are said to be and do, what the sovereign executive really is and does. And we find scientific language that favours now one, now the other, of these alternatives: the former in speaking of forces along with laws — gravitation, cohesion, electricity, for

instance; the latter in referring all these laws collectively to Nature as *her* laws. Nevertheless, the thoroughgoing naturalist, as we well know, will not defend this usage of law; but, casting it off as the last rags of a creed outworn, thinks he has freed himself from all the ontological trammels that such terms as force or cause or nature involve. He claims to use law in quite another sense. Laws of Nature are for him only uniformities of coexistence and succession. Orderly relation of the parts of a whole is here the outcome. But if we pitch upon any concrete thing or fact as possibly one of these parts, it is straightway itself resolved into coexistences and successions: indeed so long as we can single out a definite 'this' or 'that' the analytic process continues. If we ask of what sort are the relations, then attractions, repulsions, affinities, influences, are discarded phrases: activity and passivity are anthropomorphic, metaphysical. The relations are ultimately related motions, that is the most that can be safely said. We have, then, an infinity of meeting-points or starting-points of related motions, motions so related that the whole is one. As the analysis never rests till everything intrinsic is resolved into relations of elements external to each other, we may fairly say each element is constituted solely by its external relations to all the others. True, the element in such a case becomes for any clear thinking a pure nothing; for it is as impossible to get the shadowiest of 'its' out of mere relations as to get quantity by any multiplication of mere coefficients when your concrete term has vanished.

But waiving this, the laws of Nature only state the relations, they do not make them. How, then, do these elements, which are on, or over, the verge of nonentity, keep up this wondrous *rapport?* Certain physicists are fond of talking of the mazy dance of molecules; the ancient astronomers, too, imagined that the planets had souls which steered their courses. Such concerted action through mutual understanding is indeed the only form of *rapport* that is clear to us; but even concerted action on such a scale seems inconceivable. Moreover, the concerted actions that we know presuppose a medium of communication; if that were excluded we should have to fall back on 'telepathy' or, as the physicist calls it, action at a distance. And even then there would come the difficulty that these elements we are supposing to act in concert, are not allowed to act at all! Nevertheless, with extreme inconsequence, but to obviate these difficulties, the physicist postulates, not a medium of communication, but a medium, of which all his elements are motions and by which strict continuity of motion is secured. This commits him to infinity in three directions. First, his ether must be infinite in extent; for gravitation, cohesion, and the like, which it mediates for its contents, are unavailing to give it bounds or form, unless there be another ether to mediate in like manner for it. On the other hand, it is infinite in divisibility since it is absolutely continuous; in every smallest part of it, therefore, there is an infinity of elements, in other words, no elements at all. Finally, though every part of it can *be* moved, no part can move itself; the motion therefore, apart from catastrophes, can never have

begun and can never end. Perhaps I ought to apologise for this brief restatement of what was discussed so fully in the first half-dozen lectures. But there we were content to take it for what it purported to be — an objective presentment of real principles; we are now concerned with it in its relation to the human mind.

Is it anthropomorphic in itself and as a whole? — that is the first point. I answer Yes, as truly as the cosmogony of Hesiod, but it is a vastly narrower scheme. There are three things human beings can do, and by these the character of this scheme is fundamentally determined: they can move things by contact, they can measure, and they can work sums. To measure and compute motions, connected in the only manner conceivable by us, is all that this scheme will do. It is a wonderful and exact instrument, but its exactness is due mainly to its narrow range and formal character. Time is the emptiest thing we can measure, and the thing we can measure with far the greatest precision; but that gives it no supremacy over other conceptions, makes *it* no fuller, nor *them* less indispensable. The fact that mechanical laws are applicable to things shews indeed that 'things are ordered by measure and number,' but not that they *are* themselves only measures and numbers.[1]

Is a system of such laws clear at least of further anthropomorphic implications? This is the second point: I answer, By no means. That subjects with varied intrinsic qualities, that causal agents, are beyond its ken does not disprove or affect the existence of such things or such agents. These we know first and independently, and

[1] Cf. Lotze, *Metaphysics*, Conclusion.

we can pass from them to it but never from it to them. We are able to use it, just as we use mortality tables, because it is an analytical instrument of our devising. Its utility, too, is evidence that the world is verily a cosmos, but not that it is verily a mechanism. Setting out from what — as I have said — we know first and independently, causal agents and things with intrinsic qualities, the unscientific mind looks to them to account for changes, and strives to represent the world in terms of their interaction. Hence the earlier sense of laws of Nature and natural agencies, which positive science only endures on sufferance and in principle repudiates. But though this triumph of human devising contrives to leave them out, it has still left them there. Men do not cease to be every one more or less *sui generis*, seeking out many inventions with untiring energy and undaunted by difficulty, because Newton's particular genius led him to discover the laws of motion and Laplace's led him to propound the nebular hypothesis; or because, last of all, Mr. Spencer evolved a theory of the universe in terms of these, into which Newton and Laplace would have to fit. When positive science scoffs at anthropomorphism, it is playing a dangerous game. Is it anthropomorphic, only the license of the poet, to say to a man: "Thou art thou, with power on thine own act and on the world"?

But if man's intellectual and practical activity is fact and not analogy, any formulation, however rigidly mechanical, of what we call natural phenomena, must still leave room for it and come to terms with it when challenged. A large part of human activity consists in

communication and coöperation between man and man. This again is fact, not analogy, albeit fact reached only by understanding, not fact as the lightning flash and thunder clap might be called facts for any sentient with eyes and ears. Hence I shall not charge you with anthropomorphism if you accept these laryngeal articulations of mine as — not noise, that might serve to scare rooks or admit of acoustic analysis, given the necessary resonators, but as — a more or less rational discourse addressed to you. So generally, being ourselves active and intelligent, we understand certain changes, which science can only formulate as matter in motion, to be verily the acts and expressions of rationals: only so can we meet and greet our fellow-men. No advance in the essentially interminable description of that mechanism can ever conceivably alter these facts, upon which — as I have repeatedly urged — this whole business of physical description depends, nay of which it is itself a part. So far, at any rate, the teleological and idealistic or spiritual character of experience seems clear; and anthropomorphic 'confusion of ideas' so far has had no chance to obscure it. Now put mankind and other sentients capable of mutual understanding on the one side and their common environment as a whole on the other. The relations of each individual subject to that environment are not confined to those in which this serves as the medium of intersubjective intercourse, and, in fact, cannot begin with them. But, before and apart from those relations, its environment is for each subject an orderly objective continuum, affecting it immediately, and always in some measure amenable to its

acts; the environment is its counterpart or non-Ego; its microcosm we might perhaps call it. These, then, are the facts for which, I repeat, every system of Nature, mechanical or not, must find room, or at least leave room.

This non-Ego, we say, is orderly, and so, intelligible. Either, then, it is itself intelligent, or there is intelligence beyond it. Again, I interact with it or through it; either, then, it is itself causally efficient, or there is a causal agent behind it. Early thinking, so far as it faced these questions at all, answered each by affirming the first alternative. But the many concrete aspects of the environment were then so obtrusive as to shut out the whole — there was no seeing the wood for the trees, as the proverb goes. Polytheism in religion and independent forces in science were thus far on a par. But the progress of thought has made it easier to comprehend the world, at least formally, as a unity, and in proportion as the questions just raised have been fully faced, the second alternative has been accepted in lieu of the first. As 'the gods many and lords many,' so amenable to concrete representation in poetry and art, have paled before a clearer insight, they have been subordinated to a Supreme Being, beyond or above the world and only intellectually conceivable. So, too, the light, heat, and other natural agencies, so palpable and real for common sense, have become but various transformations of an underlying energy which is beyond perception. Religion and philosophy had worked their way to the sublime idea of one Supreme Being, the intelligent First Cause and Substance of all things,

long before science had accomplished its laborious task of abstractly formulating these things in terms of matter and motion. And when this vaunted formulation of all Nature is complete, when we are enabled to conceive a *mechanism*, intelligible therefore but not intelligent, in working, but too inert ever to start or alter or stop itself; how then can the questions we have asked be evaded? And if they cannot, what answer is there but that which philosophy and religion would give?

The unity of this vast mechanism, its regularity and completeness, they would say, all point to the one Supreme Intelligence as their only sufficient reason; while the inertness of all its parts equally points to Him as its Prime Mover and Efficient Cause. So spoke Descartes and Locke, Newton and Clarke, and many beside, who were prominent as workers on this fabric of modern science. Can we have the intelligible without intelligence; can we have things that wholly vanish in relations; can we have continuous process and nowhere an efficient cause? Again let me remind you that that older sense of Nature and natural laws, which I first described, though it lingers unavoidably in the less exact of the natural sciences, is treated as in principle obsolete. Matter itself and energy are, it is averred, only hypothetical conceptions — nay the whole scheme is but a descriptive apparatus. Still if there is verily something admitting of such description, it, too, must imply what the description essentially presupposes. Naturalism then, it would seem, does not escape spiritual implications, because science succeeds in strain-

ing its own doctrines clear of them. Not, let us remember, that science is to be blamed for this; all that we have a right to demand is that what is thus left out shall not be ignored, and the bare anatomy of its body offered us as the living universe itself. The completeness of the abstract separation only makes our questions more pressing and the answer more impressive. It is not till we have seen a dead body that we know how much life means. Marvellous, even though but a skeleton, is this system of positive law, beyond a doubt; but how, we ask, if this be all, can these dry bones live? Science, as such, has nothing to do with the question; but Naturalism, which has, evades it, and sends us to Agnosticism for the answer. And once again, as it seems to me, Agnosticism plays the *rôle* of traitor.

Taking Mr. Spencer to be its exponent—a very brief examination of his doctrine of the Unknowable will suffice to make this treachery clear. We are obliged, he allows, to refer the phenomenal world and all its law and order to a First Cause, and though this, he tells us, "cannot in any manner or degree be known, in the strict sense of knowing, yet its positive existence is a necessary datum of consciousness." Waiving for the moment any question as to what may be meant by 'knowing in the strict sense'; or how Mr. Spencer contrives to find between strictly knowing and not knowing at all a middle term, which shall not be opinion or belief, but positive and necessary affirmation—let us note some of his assertions concerning his Unknowable. First, he tells us, it is Incomprehensible Power.[1] But 'incomprehensible' is a somewhat

[1] *First Principles*, § 27, stereo. ed., p. 99; rev. ed., p. 85.

ambiguous word: we say the contradictory and nonsensical are incomprehensible, and we say man is incomprehensible to the brutes. It is in the latter sense that Mr. Spencer uses the word; for when the question of attributing personality to this First Cause is raised, he remarks, "the choice is between personality and something higher," and elsewhere suggests that to it may belong "a mode of being as much transcending Intelligence and Will, as these transcend mechanical motion." "This consciousness of an Incomprehensible Power," Mr. Spencer goes on to say, "is just that consciousness on which religion dwells," and he makes much of finding here a ground of reconciliation between religion and science. Then, *à propos* of Mansel's famous *Bampton Lectures*, the chief source of his own doctrine, he tells us that "our duty is to submit ourselves with all humility to the established limits of our intelligence" — which, by the way, he elsewhere describes as the 'imbecilities of the understanding!' — "Indeed, it seems somewhat strange," he continues, "that men should suppose the highest worship to lie in assimilating the object of their worship to themselves. Not in asserting a transcendent difference, but in asserting a certain likeness, consists the element of their creed which they think essential."[1] For my part, I feel that there is only too much in religious and theological literature to justify this censure. But still is it not possible to admit 'the transcendent difference' while yet asserting a 'certain essential likeness' between God and man? And, after all, have not thoughtful men in every age allowed as obvious that we cannot "find out the Almighty to perfection"?

[1] *First Principles*, § 31, stereo. ed., p. 109; rev. ed., p. 93.

But it is certain that we shall never find at all unless we seek; and yet how is search possible, if absolute difference and no likeness is the affirmation forced upon us by 'the established limits of our intelligence'? As I have already said, — and no fact of knowledge is more beyond cavil, — all positive knowing is assimilating. Either, then, Mr. Spencer must go backward, or he must go forward. If the positive and necessary datum of consciousness, having, he tells us, a higher warrant than any other whatever, be the affirmation of the absolutely different, then assuredly irrationality and nonentity are at the root of us. But if we may attribute to that Unknowable even Causality or Power, then so far we assimilate it to ourselves, as being causal agents; and, as I have argued at length, were it not that such is our nature we could not find that such too, in transcendent measure, is the nature of God. And again, if we may go this far, we must go farther still. If we were face to face with chaos, as in the opening scene of Mr. Spencer's evolutionary epic, we might perhaps identify his Incomprehensible Power with mere brute energy; but the First Cause of a Cosmos, to be an adequate cause and deserve the name, must be a Supreme Intelligence. But, in truth, experience does not warrant us in divorcing efficiency from intelligence. In a work, written many years after the publication of his *First Principles,* Mr. Spencer, discussing the development of religious ideas, himself raises the question: "How can a final consciousness of the Unknowable, thus tacitly alleged to be true, be reached by successive modifications of a conception which was utterly untrue? Surely if the primitive belief was absolutely false, all derived

beliefs must be absolutely false." And he replies: "Unexpected as it will be by most readers, the answer here to be made is that at the outset a germ of truth was contained in the primitive conception — the truth, namely, that the power which manifests itself in consciousness is but a differently conditioned form of the power which manifests itself beyond consciousness. . . . Consequently, the final outcome of the speculation commenced by the primitive man, is that the Power manifested throughout the universe, distinguished as material, is the same Power which in ourselves wells up under the form of consciousness. . . . The conception to which he (the explorer of Nature) tends is much less that of a universe of dead matter than that of a universe everywhere alive."[1] We may conclude, therefore, that so far it is only these inconsistent implications and admissions of an altogether idealistic character that save Mr. Spencer's flimsy agnosticism from being utter nonsense.

But there is still a point in abeyance. This Life of a Universe everywhere alive of which he has allowed himself to talk, is, Mr. Spencer tells us, totally and forever beyond our knowledge "in the strict sense of knowing." What, we must now briefly ask, is the precise import of this agnostic dictum? Briefly, then, Mr. Spencer's 'strict knowledge' is neither more nor less than the positive knowledge of Naturalism. For it is confined entirely to what he terms 'the veil of appearances,' the veil never lifted by the 'Inscrutable Reality' — to use another of his phrases — which it absolutely conceals; and these appearances again are either

[1] *Principles of Sociology*, §§ 659 f.

sense-particulars or conceptual relations of such. We are thus once more at Hume's standpoint, and may straightway concede the whole position to Mr. Spencer, if he is willing to take all consequences. Thus from the strict premisses of positivism we can never prove the existence of other minds or find a place for such conceptions as cause and substance; for into those premisses the existence of our own mind and its self-activity have not entered. And accordingly we have seen Naturalism led on in perfect consistency to resolve man into an automaton that goes of itself as part of a still vaster automaton, Nature as mechanically conceived, which goes of itself. True, this mechanism only goes of itself because it *is* going, and being altogether inert cannot stop or change. How it ever started is a question which indeed science cannot answer, but which, on the other hand, it has no occasion to ask: time, its one independent variable, extends indefinitely without hint of either beginning or end. Such a system of knowledge, *once we are inside it*, so to say, is entirely self-contained and complete. Mind is the alien, irrelevant, superfluous. Nature, according to this conception, contains no hint of either God or man; outside *this* is the place for Mr. Spencer's Unknowable, as what is transcendently different from it all, and Mind occupies that place. Not from within this system, but only from without and independently, can the conception of mind be brought to bear upon it. And the result is as when the sacred name is uttered in some Oriental palace of magic — the whole fabric collapses; its independent reality was an empty show. But obvi-

ously this result cannot come from within; the magician does not exorcise himself. Naturalism, I admit, talks of phenomena, but with fatal inconsistency. It only does so to rid itself of spiritual implications, and its phenomena end by being phenomena *per se* — a flagrant contradiction, of course. But work your way to that standpoint, ignoring yourself more than you can, and what do you find that is phenomenal in time, or space, or mass, or number, or in equations connecting terms involving only these? They in themselves give no hint of aught behind or beyond that supplements them, or of any gap in the system they form that needs to be filled. The 'established imbecilities of the understanding, to which we are bound dutifully to submit,' have no place here. It is precisely its independence of these that constitutes the fascination of this scheme for the naturalist who is taken out of himself and caught up in it.

An important distinction made by Kant, but only when he had reached his third *Critique*, meets us at this point — I mean the distinction between the determinant, or as we might say, mechanical, judgment, and the reflective or teleological judgment. Mr. Spencer's strict or positive knowledge is wholly the work of the former; knowledge of other minds we reach only by means of the latter. In the former we constitute the whole from the parts; in the latter we interpret the parts from the whole. In the latter, meaning and purpose, deeds and ends, are everything; in the former, all of these are lacking. From the reflective judgment as *prius* to the mechanical judgment the way is easy; from the me-

chanical as *prius* to the reflective there is strictly no way at all. No doubt in the various theories of psychophysical parallelism an attempt is made to find a way, so far at least as to connect mind with mechanism; since the existence of finite minds at all events cannot be wholly ignored. And if those theories fail hopelessly in the case of finite minds, is it likely that the same method can lead us to any adequate idea of the First Cause of all this mechanism? By parity of reasoning on these lines God should be, if He is at all, the collateral product of the universal mechanism, another aspect of matter in motion. Monistic literature since the days of Spinoza abounds in notions of this class, but they only save themselves by negating themselves, to use a Hegelian phrase. The moment mind and matter are mentioned together matter appears at once as secondary and dependent, so surely as mind is active and matter inert, so surely as mind has meaning and purpose, and matter only subserves them. This has been the burden of our argument since we entered upon epistemological questions, and I do not need to enforce it afresh, but only to apply it to Mr. Spencer's dictum.

We attain the knowledge of all minds, the minds of other creatures, the Creative Mind and even our own, only by reflexion, interpretation, understanding. We are adepts at this kind of knowledge before we have even begun to acquire the positive, constructive, mechanical knowledge by which we conceptually summarise the world. But this we can do without understanding it at all, just as a compositor can set up the type, letter by letter, of a piece of literature in entire ignorance of

its sense. Between these two forms of knowledge, between the determinant and the teleological judgment, the difference is not one of degree: it is a difference of kind. No insight into printing processes will make a *littérateur* or even a critic. But only a man who had never been outside a printing-office could imagine that literature was but a collateral product, a mere aspect of letterpress, or an inscrutable something that lurked forever behind it. This analogy, however, is not in all points exact, but to note where it breaks down will help us forward. Unquestionably letterpress is only a means to an end, not an end in itself. But in Nature we can never say that anything is means only; it is more reasonable to regard all as meaning, even though we often do not know what. And, accordingly, if we allow the conception of a Supreme Mind and First Cause to be valid at all, we shall not have God *and* interminable mechanism as His medium and instrument: really, fundamentally, ultimately we shall have God only and no mechanism. It is verily a case of all or none; which we find, God or mechanism, depends upon our standpoint, but we cannot from either standpoint find both. From the one standpoint, for rational reflexion, for philosophy, the conception of the course of Nature as a pure mechanism is an obvious fiction, as much a mere organon as a table of logarithms—a transparently human device, and so far thoroughly anthropomorphic. Nevertheless, the fact that the course of Nature *can* be abstractly summarised in mechanical formulæ is evidence of a congruity between thought and things, which justifies the idealist position. But from the other standpoint, for the formulæ themselves,

the conception of God is not, as Laplace remarked, a hypothesis that they do not need, but a conception wholly without and beyond their horizon. But the same is equally true in principle of all other minds, as the ineptness of psychophysical parallelism and the contradictions of dualism sufficiently shew. It is precisely the independence—at first so fascinating—of the mechanical scheme that in the end, when reflexion begins, makes its dependence the more certain and impressive.

But there is still one point in Mr. Spencer's characterisation of theistic knowledge which we must not pass without a word—I mean his use of the distinction of appearance and reality—a distinction which has ever been the stronghold of Agnosticism. Strict knowledge, he gives us to understand, is confined to appearances, behind which God remains wholly and forever concealed as Inscrutable Reality. The term 'phenomenon,' like many other philosophical terms that have obtained common currency, has thereby acquired so many and such diverse meanings as to make careful scrutiny imperative, whenever it reappears in philosophical discussion. We have allowed that 'strict knowing,' if it is to mean the resolution of the course of Nature into coexistences and successions, and these again into a world-formula in terms of matter and motion, does not reveal God at all, or mind of any sort. But I would now urge that such a formula is not 'a veil of appearances,' is not in propriety of language phenomenal at all. "The idea of phenomenon or appearance," says Lotze, "in order to be intelligible must presuppose not only a being or thing which appears, but also, and quite as indispensably, a

second being by whom this appearance is perceived."[1] But who has ever perceived mass-points in motion, vortex-atoms, or ethereal undulations? The whole purport of these is that they are ideal conceptions, not actual perceptions; not really appearances at all, but only symbols of perceptions which are the real appearances. And when science forgets this and, inverting the true relation, declares perceptions to be themselves the symbols and its own abstracts the true phenomena, it perpetrates the absurdity we have so often stigmatised of phenomena *per se*. But if we decline to call anything an appearance, unless it is either perceived or perceptible, why then should we attach to it the bad sense of concealing, rather than the good sense of revealing? Why should appearances not be reality? Nay what else can they be? How can reality appear, shine forth, and yet remain totally and forever beyond the knowledge of those to whom it appears? Let us turn, as we have done before, to the case we know best — the communication of one human mind with another. Assuming good faith, we never regard a man's acts and utterances as masking, but rather as manifesting the man. If they mask when it is his intention to deceive, surely they cannot also mask when his intentions are the precise opposite. These acts and utterances may be beyond the comprehension of men on a lower intellectual level, and with narrower horizons, but they are not the less real or true on that account. And why should we argue differently, when reflexion leads us to see in a Universe declared to be 'everywhere alive,' the manifestations of a Supreme Mind?

[1] *Microcosmus*, Eng. trans., ii, p. 160.

This brings us to another agnostic objection — but one raised this time, not by Mr. Spencer, but by the late Professor Clifford, though it has been in substance a commonplace objection with anti-theistic thinkers since the days of Epicurus. Finite minds, it is said, manifest themselves by interfering in the course of Nature. Primitive man imagined that he discerned like interferences of a superhuman kind; and from such premisses concluded correctly enough that "God walked with men." But now it is maintained, as I once heard Du Bois-Reymond say, that Science has banished the gods from the universe. This objection again, though it has unquestionably had weight for ages, seems to lose all its force, once we take account of the difference between the Mind that lives in the whole of things, and the minds that are confined to parts. To overlook this difference is to be guilty of the fallacy of 'the poor Indian philosopher,' whom Locke has immortalised.

No doubt this objection has been indirectly confirmed by the "fanaticism that would like to see the Supreme Good active in some other way than that which it has itself chosen, or which believes its end to be attainable by some shorter path than the roundabout way of formal orderliness which it has itself entered upon."[1] Once again let us turn to what we know first and best: let us consider how this objection would look if applied to the thoughts and acts of a human mind regarded as a whole in themselves. When a man sets to work to expound a theory or to carry out some practical project, he does not retract earlier statements, or change his

[1] Lotze, *Microcosmus*, e.t., ii, p. 727. Amended.

first plans, save to amend his own error or to remedy unforeseen defects: the more he is master of his purpose the less of such interference there will be. And when we look at the collective results of human thought and practice, we see that, the more they approximate to perfection, the more they have of fixity, or at least of orderly progress. Finally in the intercourse of man with man, the more steadfast purpose is directed by clear insight, the more intimate the unity and community that is possible; the more expectations are realised, the more sure and secure is each among all. But the prime foundation of all such life and intelligence is that perfect orderliness of Nature which science mistakes for brute, mechanical necessity.

But is it needful to say again that the laws of Nature are not self-existent at all, and that therefore their necessity can *not* be the necessity of a Fate? Science cannot at once renounce metaphysics and play the metaphysician. It was allowable for atheists and deists alike, who still held to the notion of substantial causes, to regard the world —whether started by Divine Power or not—as now left to itself. But from such a position modern Naturalism is cut off by the meaning it has given to law. So soon as laws are defined as constant relations, so soon reason compels us to look beyond them. Such a definition brings the ground and source of the relations nearer instead of removing them farther off. Relations may hold, but they cannot operate; they may subsist, but they cannot exist in the absence of the things to which they pertain. Matrimony is a constant relation, and actual so long as there are husbands and wives; service is a constant re-

lation, and actual provided there are masters and servants. The only *things* of which we have positive knowledge are subjects with intrinsic qualities, things that are something in themselves and something for themselves. All else may be resolved into relations between these. Hence science, which replaces qualities by relations, ends with the conception of empty and formless matter, that is nothing for itself, or in itself, that can receive no determination and can impart none. Again, such subjects are the only *causes* of which we have positive knowledge: they have a nature of their own and hence can interact, determine, and be determined. And here again natural science that knows not mind knows not cause: causes are replaced, therefore, by transferences of motion between one portion of the ἄπειρον and another, transferences only mathematically determinate and otherwise inconceivable. Is it not plain, therefore, as I have argued at length before, that reality consists in the concrete things and events that science sets out from, and not in the network of relations which is its goal? If then, as rational beings who have other ends in life than calculating and classifying, we want to interpret and understand the full meaning of the world, must we not return to it in its fulness and variety? When we so regard it, and consider first what we know best, the interaction of mind with mind — and this *must* be the basis of our interpretation if we are to understand at all — we do not say, that between man and man there intervenes some entity called a body of relations. The intercourse, the coöperation or conflict, actual or possible, of the individuals themselves is their relation. As Lotze forcibly puts it: "The passion and

action of things must take the place of relation. Just when, and in so far as things act on one another, are they related to one another; there are no objective relations other than this living action and passion."[1]

Why, then, if law and order are only intelligible as the outcome of intelligence, may we not regard each individual subject, everything that is anything for itself and in itself, as a living law, or if you will as an active essence or character, interacting in its own peculiar manner with other subjects equally determinate? With experience in the concrete, we can deal satisfactorily in no other way, and no competent thinker dreams of interpreting the history of the world by means of a scheme of universal laws. In history—natural as well as civil—we find no mere repetitions, no absolute fixity, small scope for measurement or for mathematics, the indispensables of all 'scientific' *conception;* yet, though affording thus little foothold for positive and exact science, the historical is what we *understand*[2] best and what concerns us most. How far below us, how far above, the historical extends, we cannot tell. But above it there can be only GOD as the living unity of all, and below it no longer things, but only the connecting, conserving acts of the one Supreme. Such a view, it may be said, is incompatible with the scientific conception of law; for that postulates necessity, whereas this lets contingency into the very heart of things. It

[1] *Microcosmus*, ii, p. 635.

[2] On the antithesis between conceiving (Begreifen) and understanding (Verstehen), see an interesting paragraph in Paulsen's *Einleitung in die Philosophie*, 2 Aufl., p. 384.

is true: I not only admit it, but contend that any other world would be meaningless. For the contingency is not that of chance, but that of freedom;* so far as everything that is is a law in itself, has an end for itself, and seeks the good. In such a world there is still room for rational necessity, and more than this scientific generalisations do not justify and cannot demand. For where rational necessity is supreme, freedom is possible, and things must be intelligible. No sane man resents as a constraint normal laws of thought, normal laws of conduct, normal laws of taste, or demands that truth, goodness, or beauty should be other than they are. Real freedom consists in conformity to what ought to be. For God, whom we conceive as essentially perfect, this conformity is complete; for us it remains an ideal. But were we the creatures of a blind mechanical necessity, there could be no talk of ideal standards, either of thought or of conduct; no meaning in reason at all.

Now one thing at least is certain: experience does not start confronted and determined by mechanical necessity; and the conclusion to which we are led is that—provided we keep the whole of it clearly in mind—it does not end so confronted and determined. Science is ever appealing to experience, and to experience we have gone, only insisting that there shall be rendered to it all that is its due. For science has left the historical so long aside that it is beginning to forget that experience in itself is historical at all. We have, therefore, on the other hand, to insist that it is historical altogether; and the fact is happily one there is no gainsaying. Yes, the actual is wholly historical; and so far, too, it is 'the

* See Note iii, p. 614.

unknowable in the strict sense of knowing'; in its concrete fulness, that is to say, it has defied and will ever defy all our attempts at adequate formulation. And precisely on this account must science ignore it, so long as the ideal of science is calculation and measurement. Steadfastness to such an ideal cannot but entail the exclusion from strict science of all but 'necessary truths'; whereas for us experience as a whole consists from end to end of 'contingent truths.' The difference between these Leibniz happily compared to that between commensurable and incommensurable numbers. "For as with commensurable numbers," he says, "resolution into a common measure is possible, so with necessary truths a demonstration or reduction to identical truths can be found. But just as surd ratios . . . lead to an interminable series, so contingent truths involve an analysis that is infinite, and possible to God alone."[1] This incommensurability of the necessary and the contingent, the scientific and the historical, answers to the difference between validity and reality, and shows, at the same time, that "reality is richer than thought." Thought gives us only 'science,' not existence; we cannot, by piling up propositions, secure the simplest 'position.' Thought, again, gives us only the 'universal,' the relational; from the 'particular,' which is the 'surd' for it — or the real meeting point or subject of relations — it must start, but to this particular it can never return save by traversing an interminable series.

But this reality, richer than thought, is experience. Science cannot originate experience; for experience is the

[1] *De Scientia Universali*, *Opera*, Erdmann's edition, p. 83.

source of science, yet always more than its product, so surely as the workman is more than his tools. Science is but the skeleton, while experience is the life;[1] science but a means, and experience the end itself. And when we examine that necessity which is the boast of science, the ground of its utility and the criterion of its perfection, how singular is the result we find! For the sake of this ideal, the historical is ignored, the metaphysical eliminated, substance and cause become fetishes, God a superfluous hypothesis, and mind an enigma, a troublesome by-product, a veritable ghost that cannot be laid. Nevertheless this necessity itself remains inexplicable, and in turn is scouted as but a shadow of the ghost, or anathematised as an intruder. Naturalism can do nothing without it, and Agnosticism can do nothing with it. For the one can only attain reality by treating necessary truths as truths of fact, and the other can find no necessity in facts at all. But these necessary truths, we have seen, are as Leibniz rightly called them, truths of *reason*. They originate in the subject of experience, not in the object; but if the objects conform to them, then all experience is rational; our reason is confronted and determined by universal reason. Such is the world of spiritualistic monism, and to this world, as I have tried to show, Naturalism and Agnosticism eventually lead us in spite of themselves. Thus their demurrer to theistic inquiries is not sustained. The Realm of Nature turns out to be a Realm of Ends.

[1] Cf. Lotze quoted above, p. 252.

SUPPLEMENTARY NOTE TO PART I

NATURALISM is not science, and the mechanical theory of Nature, the theory which serves as its foundation, is not science either. There are still, happily, many scientific men of eminence who reject the naturalistic philosophy—for philosophy it is—emphatically and entirely. And as to the mechanical theory in particular, what I ventured to say of that six years ago is truer than ever to-day:—"The mechanical theory as a professed explanation of the world, receives its death-blow from the progress of mechanical physics itself" (p. 139, above).

Nevertheless, though Naturalism and the natural sciences, the Mechanical Theory of the Universe and mechanics as a science are logically distinct, yet the two are at first sight very similar and historically are very closely connected. Between the natural sciences and philosophies of the idealist (or spiritualist) type there is indeed no danger of confusion, for all such philosophies necessarily involve criticism of the epistemological assumptions which science unconsciously makes. Not so with Naturalism, which is as innocent of any theory of knowledge as science itself. In fact Naturalism, like Materialism, is only physics treated as metaphysics—a mistaken identification, which has tainted our so-called Natural Philosophy at least since the days of Descartes. Naturalism is less dogmatic than Materialism, no doubt; owing to its agnostic reservation as to the nature of ultimate reality; but it insists emphatically on the priority of the material aspect of its Unknowable. When the essentially philosophical question, how best to systematise experience as a whole, arises, the naturalist—as we have seen—contends that we must begin from the physical side. Then only are the facts precise, determinate, and rigorously concatenated: every thought that ever stirred the human heart, not less than every breeze that ever

rippled the bosom of the deep can, it holds, be traced to a perfectly definite redistribution of matter and motion. To the mechanical principles of this redistribution an ultimate analysis, it is said, brings us down; and from these principles—aided by the nebular hypothesis and the theory of natural selection—all subsequent synthesis is to be explained. Life and mind take throughout a secondary place: cosmical mechanism not only precedes them but determines them, and they are powerless to modify it. The mental becomes the 'epiphenomenal,' a merely incidental phosphorescence that regularly accompanies material processes of a certain type and complexity. That propositions of such philosophic generality and scope are legitimate deductions from physical science, few, if any, of our modern physicists are bold enough directly to maintain. But many of them consider that their science itself is attacked by those who seek to lay bare the latent metaphysics, the physical realism, on which the Mechanical Theory of the Universe rests.

The criticism of this theory in the preceding lectures has been so regarded. It has been described as an "attempt to prove that the science of mechanics is no true science at all"; and again as making the "exactest of sciences impossible"; and finally as exhibiting "a dislike, a contempt, a hatred, a loathing of everything connected with science!" In point of fact my criticism rests throughout on the expositions of a school of physicists—if one might call them so—steadily increasing in number and influence, who reject entirely the almost mediæval realism imparted by Descartes to modern physics. This realism has remained so long unquestioned, that to challenge it now seems to many to spell scientific anarchy. And yet it surely verges on extravagance to suppose that men like Kirchhoff or Poincaré—to mention only two out of many distinguished names —who do challenge it, are seeking "to invalidate the methods of science" or to prove that "mechanics is no true science at all." To distinguish them from the old school, whom we may fairly term physical realists, we might call the new school physical symbolists. The term is not very happy, but it may at least serve to emphasise the one difference between the two which now specially concerns us. The question at issue is very simple. Both schools start, of course, from the same perceptual experiences; both employ an abstract conceptual system, differing in detail but essentially the same; both resort to the same methods of verification. But the one believes that it is getting nearer to

the ultimate reality and leaving mere appearances behind it: the other believes that it is only substituting a generalised descriptive scheme that is intellectually manageable, for the complexity of concrete facts which altogether overtask our comprehension. On either view the value of physics as systematic knowledge *about* things is unaffected: its possibilities of future extension and of practical application are in either case the same. But the speculative difference between the two is immense, and in this respect the question which is right becomes important.

Which then is right? This question may be argued from two distinct standpoints: from the general point of view of epistemology or from the more special one of the logical structure and method of the science of physics itself. In the fourth part of these lectures I have attempted to show that epistemologically the realistic interpretation of physics is untenable, and in this first part my contention is that the symbolic character of physics is completely borne out by what we may call the internal evidence of the science itself as well as by its past history and recent progress. I should assuredly never have dreamt of daring to meddle with physics as a positive science, still less of attempting to invalidate its methods or belittle its splendid achievements. There is a striking passage in Mr. Bradley's *Appearance and Reality*, which I have had throughout before my eyes:—"As a working point of view, directed and confined to the ascertainment of some special branch of truth, Phenomenalism is of course useful and indeed quite necessary. And the metaphysician, who attacks it when following its own business, is likely to fare badly.[1] But," he continues in words that I have already quoted (p. 60, above), "when Phenomenalism loses its head and, becoming blatant, steps forward as a theory of first principles, then it is really not respectable. The best that can be said of its pretensions is that they are ridiculous."[2] This blunder I believe that physical realism has perpetrated so far as it has advanced or defended the mechanical theory of nature. And it was solely against these 'pretensions,' and the realistic interpretation of physical conceptions on which they rest, that my strictures were aimed.

Sir A. W. Rücker, as President of the British Association in 1901, devoted his Inaugural Address to a defence of physical realism against the symbolic interpretations recently advocated

[1] Mr. Bradley was thinking perhaps of Hegel.
[2] F. H. Bradley, *Appearance and Reality*, 2nd ed., 1897, p. 126.

by Professors Poincaré[1] and Poynting[2] and by myself. Principal Rücker is more judicious than many of his predecessors and confines his defence within very moderate bounds: the mechanical theory of Nature he seems to reject altogether, as "repugnant to common sense." He is satisfied with maintaining a *via media* between this and "the opposing assertion that atoms and the ether are mere figments of the scientific imagination." "It is a mistake," he says, "to treat physical theories in general, and the atomic theory in particular, as though they were parts of a scheme which has failed if it leave anything unexplained." To treat physical science in this fashion would certainly be an unjustifiable mistake, for that is usually 'respectable' enough to acknowledge its limits and to mind its own business. But it is otherwise with Naturalism, which does "step forward as a theory of first principles" and claims to be a philosophy. For *Naturalism*, then, to admit that it leaves anything unexplained or that it is repugnant to common sense amounts *pro tanto* to a capitulation.[3] But Sir A. Rücker is not a 'naturalist,' nevertheless, in spite of his reservations, his claims on behalf of atoms and the ether seem to exceed the bounds of scientific propriety. Let us endeavour to examine his argument.

He maintains that we can argue back "from the phenomena displayed by matter to the constitution of matter itself, which we cannot directly perceive"—and therefore cannot perceive at all, for indirect perception is, strictly speaking, no longer perception. This argument he conceives admits of development through successive steps in a "series of propositions, the proof of each of which is based upon a few crucial phenomena." At the same time he frankly acknowledges that the development can never be complete, "that the ultimate nature of things is, and must remain, unknown." But is not even this abated confidence untimely? It is true indeed that the progress of the physical sciences of late has been unprecedented. The recent vast extension of their experimental methods, and the many strange and unexpected discoveries to which these have led, compel our admiration. But what is the result? Whilst Principal Rücker was thus confident of getting nearer to "a copy and not a mere diagram of the truth," we find another

[1] Address to the International Congress of Physicists at Paris, 1900.

[2] Presidential Address to the Mathematical and Physical Section of the British Association, 1899.

[3] Cf. above, p. x and p. 357.

distinguished physicist, Professor Boltzmann, addressing a similar assembly, drawing the following very different picture of the prospect :—"The majority of the novel phenomena here described have been investigated as yet only superficially. . . . But theory has been hard put to it by the new facts. The intellectual tranquillity into which she lapsed from her belief that she had comprehended everything has been rudely shaken, and no attempt has yet been successful in bringing the new phenomena under so successful a point of view as the old. In fact, everything is still in a state of vacillation and fermentation." Then, after referring to the "philosophical criticisms of the foundations of mechanics formulated by Kirchhoff" and "pushed to their last consequences" by Hertz, to the revolutionary ideas awakened by the advances of electrodynamics and thermodynamics, and to the consequent growth of 'Energetics,' he continues : "To-day the battle of opinion rages tempestuously. . . . What will the outcome be? Will the old mechanics with the old forces, stripped of its metaphysical garb, continue to persist in its main features, or is it to exist henceforward merely in the pages of history? . . . Are the essential constituents of the present molecular theory . . . to endure for all time, . . . or . . . is the conception of a pure continuum as the most adequate representation of nature to prove victorious? Will mechanical models in any case persist, or will new, non-mechanical models prove better adapted, and the component factors of energy control absolutely the domain? . . . Is it possible that the conviction will ever arise that certain representations are *per se* exempt from displacement by simpler and more comprehensive ones, that they are *true?* Or is it perhaps the best conception of the future to imagine something of which one has absolutely no conception?"[1]

And now to return to Sir Arthur Rücker. Of the successive steps "back from the direct impressions of our senses to the constitution of matter itself," he develops only two. In the first step—which the ancient atomists had already taken—he infers the coarse-grainedness of matter from the phenomena of diffusion, expansion, and heat. But at the outset this inference is wholly analogical:[2] what we see in a cloud of dust or a swarm of flies

[1] *The Recent Development of Method in Theoretical Physics*, translated from the Proceedings of the Gesellschaft deutscher Naturforscher und Aerzte, in the *Monist*, 1901, pp. 240, 255 f.

[2] On this point Epicurus, the earliest atomist of whom we have precise

we imagine extended indefinitely. But Principal Rücker is not content with this: any other interpretation of his crucial phenomena he regards as "absolutely unintelligible." Such a position, however, is epistemologically indefensible: it would require us to regard every unanalysable fact, everything ultimate or *sui generis* as *ipso facto* absurd.[1] The phenomena appealed to suggest indeed that matter, so far as they are concerned, is resolvable into discrete parts; but they do not shew this to be either logically necessary or perceptually a fact. The most we can say is what Leibniz said long ago: "C'est ce qui remplit le mieux l'imagination." If we make this assumption we can form a mental picture of processes that we might otherwise have to regard simply as facts. But there is no absurdity in simple facts.[2] "Up to this point," says Principal Rücker, no question arises as to whether the separate parts are, like grains of sand, mere fragments of matter; or whether, though they are the bricks of which matter is built, they have, as individuals, properties different from those of masses of matter large enough to be directly perceived." Apparently it is only the second step that decides for the latter of these alternatives. In that case the first step need not further detain us. "That matter is grained in structure," said Professor Poynting in the address already referred to, "is hardly more than an expression of the fact that in very thin layers it ceases to behave as in thicker layers. But when we pass on from this general statement and give definite forms to the granules, or assign definite qualities to the intergranular cement, we are dealing with pure hypotheses." In other words, the first step can scarcely be said to carry us at at all beyond the phenomena displayed by matter towards the constitution of matter itself.

It is far otherwise with the second step when that at length begins. This is not so much a step as a leap; for in the exposition of it we find ourselves confronted at once by such terms as 'physical *basis* of matter,' 'ultra-physical entities,' 'quasi-material substances,' and 'concealed causes of physical phenomena.'

records, appears to have insisted. Cf. Lange, *Geschichte des Materialismus*, i. p. 79.

[1] Cf. article by Professor Poynting, *Physical Law and Life*, in the *Hibbert Journal*, July 1903.

[2] Moreover, the energists, as distinct from the atomists, contrive to deal with these processes by other and fewer assumptions. Whether their treatment is equally complete is disputable, but at least they have made tremendous headway within the last few years.

Such language at once rouses the suspicion that if in this step we are taken beyond the phenomena displayed by matter, it is only because, as Professor Poynting has said, "we are dealing with pure hypotheses"—perhaps metaphysical hypotheses. According to Principal Rücker, however, we are leaving "matter as it seems to be," and "dealing with something . . . which has properties different from those of matter in bulk." "To show this," he says, "is easy; for if the basis of matter had the same constitution as matter," then "in the case in which a hot body is prevented from losing heat to surrounding objects, its sensible heat should spontaneously decay by a process of self-cooling." He adds: "No such phenomenon is known." If this meant that the case supposed is a purely hypothetical one incapable of rigorous verification, that would be true. But what is meant, no doubt, is that, in spite of the "uncertainty of experiment," this ideal case would actually be found to hold good if the conditions imposed could be realised. Let us grant this; but what then? This ideal case implies another with which it is implicitly compared, that, namely, of a collection of bodies of sensible mass in irregular motion, and cut off from interaction with all bodies outside. In both cases the total mass and the total energy will, it is assumed, remain unchanged; but in the second case the kinetic energy of the sensible masses will be "frittered away," till at length we have one mass of uniform temperature, and afterwards no further change. In other words, the second case will eventually become identical with the first, the irregular sensible *motions* having been transformed into their equivalent of sensible *heat*—that is, into irregular, insensible motions of the particles reached in the first step. But now suppose that, instead of remaining constant, this sensible heat in turn were "frittered away" by a "process of self-cooling." How should we interpret this result? We should assume that the irregular motions of these particles, the *sensible* heat, had been transformed into irregular motions of smaller particles out of which these were built up, *i.e.* into *insensible* heat: we should infer, that is to say, that there existed a heat of a higher order. As this does not happen, it may be concluded that, *so far as the particular 'crucial phenomenon' is concerned*, the said particles are ultimate. But that is no reason for describing them as the physical basis of matter, or even for attributing to them properties different from those of matter in bulk. So far they only differ from that as a single grain differs from a heap of

grains; or—it may be—as a packet of grains differs from a heap of similar packets. But now, instead of isolating the body, the chemist claims to show, perhaps by heating it still more, that sometimes the one, sometimes the other of these alternatives holds. In the one case, since the supposed particles have been decomposed, he maintains that they must really have been compound; but in the other, where such decomposition cannot be effected, he maintains that the particle must at least so far be regarded as simple.[1] And so we reach the notion of the eighty odd elementary substances in which for the present the chemical analysis of matter ends. Even with this analysis, however, we are not really beyond the first step. We have assorted matter in bulk into eighty heaps of grains of as many different kinds, but each grain still differs from its heap only in being a grain and not a heap. The phenomena displayed by these heaps lead us to imagine the grains, but we have yet to assign differentiating qualities to the grains themselves.

It is only with this task that Principal Rücker's second step properly begins. "The idea that entities exist possessing properties different from those of matter in bulk is," he says, "forced upon us at the very threshold of our study of nature." But so far as I can see, this very safe and general statement, which even Berkeley might have made, is not followed up by the mention of any crucial phenomena showing that the particles of the physicist or the elements of the chemist are such entities. In fact the whole tenor of his address gives one the impression that Principal Rücker only claims to have made his first step secure. Thus, to cite but one passage out of many: "The cogency of the proof that matter is coarse-grained is," he says, "in no way affected by the fact that we may have grave doubts as to the nature of the granules." With the attempt to determine this nature, the second step then, as I have said, professes to begin. Leaving the phenomenal behind us we are now to be confronted with the 'ultra-physical entities,' 'quasi-material substances,' etc., which I have already mentioned. At the

[1] Not all chemists, however, are thus confident; for certainly it must be said that here again we have neither logical necessity nor perceived fact. Accordingly, some chemists of the new school seek not only to dispense with the help of the atomic theory, but even deny that elementary substances still exist as such in their so-called compounds. Cf. on this point Professor Liveing's *Crystallisation*, a Royal Institution Lecture; *Nature*, xliv. p. 150; and especially Duhem, *Le Mixte et la Combinaison chimique*, 1902.

outset Principal Rücker distinguishes two theories, or rather classes of theories, between which he does not venture to decide: (1) that the granules are "distinct in kind from the medium which surrounds them"; (2) "that they are parts of that medium existing in a special state." These two theories, he thinks, "are not by any means mutually exclusive," though how even an ultra-physical entity can be distinct in kind from that of which it is a part or a state is not clear. If we suppose, however, that the granules are not entities at all, but that on the one view they are stages in the analysis, or simplification of gross matter, regarded as indefinitely divisible, and on the other as stages in the synthesis or complication of ether regarded as absolutely continuous, then indeed the two theories cease to be mutually exclusive. They become complementary aspects of the same thing. The phenomenal atom is conceived as really ether. Such a view removes the mechanical stumbling-block of action at a distance, and provides a "physical basis of matter" that is at least worthy of the name. In principle, that is to say, it has these merits, but so soon as the attempt is made to fill in the outline, such merits seem to be purely formal. As Maxwell has said, "The properties of a body supposed to be a uniform *plenum* may be affirmed dogmatically but cannot be explained mathematically." Hence Descartes' philosophical conception of matter, which was of this sort, succumbed to the Newtonian doctrine of attracting particles; and though Newton "sought for the mechanism of gravitation in the properties of an æthereal medium diffused over the universe,"[1] his efforts, as is well known, were fruitless, and he was content merely to insist that some such medium must exist.

As regards the ether the situation in the present day can hardly be said to have fundamentally changed. Like Newton, Principal Rücker postulates a medium, to avoid the supposed absurdity that "matter can act where it is not"; and yet he advances no crucial phenomena that disclose the nature of "this simpler machinery immediately below the complexities of superficial phenomena." As with Newton, so still; the medium is wanted to make the material mechanism clear, and yet the medium itself cannot be got mechanically to work as it is wanted. "It must be a medium which can be effective for transmitting all the types of physical action known to us: it would be worse than no solution to have one medium to transmit

[1] Maxwell, *Encyclopædia Britannica*, 9th ed., s.v. *Attraction*.

gravitation, another to transmit electrical effects, another to transmit light, and so on." [1] The crucial phenomena that will uniquely determine such a medium are, surely, still far to seek, to say nothing of the further, more complex, problem of its differentiation into material atoms.

As regards this atomic constitution of matter the only prospect seems to be—as I have already urged (cf. above, pp. 120 ff.)—that of an indefinite regress with no true atom as a resting-place till the purely dynamical notion of 'centres of force' is reached; and that can never happen. Still, great strides seem to have been made in this direction of recent years. What the periodic law of Meyer and Mendelejeff (cf. above, p. 103) and the spectroscopic investigations of Sir Norman Lockyer suggested as possible, Professor J. J. Thomson appears actually to have accomplished. If his interpretation of his interesting experiments be correct, the chemical atom has been broken. It must be henceforth conceived as made up, according to its 'atomic weight,' of from 1000 to 240,000 'corpuscles,' as he has aptly termed them because of their resemblance to the famous light corpuscles of Newton's *Opticks*. The chemical atom in fact becomes a system geometrically and kinematically far exceeding in complexity the solar system as known to the astronomer. The whole organon of mechanical conceptions—kinetic and potential energy, attractions, repulsions, impacts, elasticity, vibrations, rotations, and so on—are again involved. What reason is there, then, for confidence that the application of this conceptual apparatus to these corpuscles will not still entail the old distinction of matter in bulk and constituent granules? The pursuit of the ultimate atom is thus like the fabled pursuit of the mirage: the goal appears always within reach, yet is always receding.

One thing at least seems certain: this pursuit has so far led to the discovery of nothing in the nature of the granules that entitles them to the designation of 'ultra-physical' or 'quasi-material.' Science ever since the time of Descartes has regarded only the so-called primary qualities of matter as objective or real, and these—configuration, motion, and force—are present alike in sensible masses and in material particles; "even an atom," says Maxwell, "when we consider it as capable of rotation, must be regarded as consisting of many material particles" (cf. above, p. 52). If, setting continuity at defiance,

[1] Prof. Larmor, article *Æther*, *Encyclopædia Britannica*, 10th Ed.

we were to overleap the interval between Professor J. J. Thomson's 'bodies smaller than atoms,' and betake ourselves to Boscovich's dimensionless centres of force, we might indeed call these ultra-physical entities and quasi-material substances. But most people would prefer to call them analytical abstractions, 'convenient fictions' which it would be unwarrantable to regard as substances or entities of any sort. Similar remarks are applicable to the conception of a primordial medium or ether. The science of hydrodynamics works with the conception of a perfect fluid and the theory of elasticity with the conception of homogeneous bodies, albeit the evidence is all against the existence of such fluids or bodies. When the ether is regarded as at once a perfect fluid and perfectly elastic, shall we say that it is no longer merely a working hypothesis, but that these are actual properties of an ultra-physical entity or quasi-material substance? And if the ether itself is a hypothesis, how can its differentiation into the vortex-atoms of Lord Kelvin, or the strain-atoms of Professor Larmor, or the like, be other than hypothetical?

It would be a sufficient triumph for science if every such hypothesis proved adequate to embrace all the known facts. The beautiful conception of Lord Kelvin, for example, has already failed to stand this test, and the attention of physicists is now challenged by another so entirely revolutionary that it is actually entitled *An Inversion of Ideas as to the Structure of the Universe.* According to its author,[1] "the probability that there should be another structure for the universe which would satisfy the same evidence must be indefinitely small!" We may fairly confront such overweening confidence with the concluding words of Maxwell's admirable primer: "The investigations of molecular science have proceeded for the most part by the method of hypothesis, and comparison of the results of the hypothesis with the observed facts. The success of this method depends on the generality of the hypothesis we begin with. If our hypothesis is the extremely general one that the phenomena to be investigated depend on the configuration and motion of a material system, then if we are able to deduce any available results from such an hypothesis, we may safely apply them to the phenomena before us. If, on the other hand, we frame the hypothesis that the configuration, motion, or action of the material system is of a certain definite kind, and if the results of this hypothesis agree

[1] Professor Osborne Reynolds, *Rede Lecture,* 1902.

with the phenomena, then, unless we can prove that no other hypothesis would account for the phenomena, we must still admit the possibility of our hypothesis being the wrong one."[1] Substantially the same position is put still more strongly by Professor Poincaré. Unless the principles of the conservation of energy and of least action are satisfied, no mechanical explanation is possible, and when they are satisfied there is not only one possible explanation but an infinity of such.[2]

The contention of Principal Rücker's Address—that Nature is really and truly a mechanism of atoms and ether, or else is unintelligible—is, then, we conclude, logically unsound. His second step, we find, adds nothing essentially new to his first. The conceptions of configuration and motion of masses cannot be made to carry us further from physical phenomena and nearer to ultra-physical reality by diminishing the scale. The conceptions of perfect rigidity, perfect elasticity, or perfect fluidity again, for which there is no empirical justification, are surely none the more entitled to be regarded as properties 'of a substance other than ordinary matter' because as ideals they help us to form a possible model of its working. But how far does Principal Rücker really intend to go? He is constantly talking of 'mental pictures,' while constantly protesting that atoms and ether must be more than these. Such procedure practically amounts to saying: In this case I can form no other picture, and therefore the reality must be like it. And yet Principal Rücker's confidence does not carry him thus far. He is fair enough to allow the abstract possibility of a different mental picture. Atoms and ether, then, cannot be either presented realities or necessities of thought. Nay, he allows "the tentative nature of some of our theories"; he admits "many outstanding difficulties." After all, then, he is only defending a working hypothesis, and one, moreover, that has lost greatly in prestige in the last half century. But if the atomic and other theories of the constitution of matter are but working hypotheses, and hypotheses strictly confined to physical phenomena, there is no justification for a theory which maintains that mechanism is fundamental everywhere and reduces the

[1] *Matter and Motion*, p. 124.

[2] *La Science et l'Hypothèse*, pp. 256 f. Principal Rücker chooses to regard this as applicable only to "explanations of isolated phenomena," but I can find no warrant for any such restriction, and Professor Poincaré himself explicitly maintains the contrary (cf. p. 197).

facts of life and mind to epiphenomena—makes them, that is to say, a degree more phenomenal, a degree less real than matter and motion. Such is the mechanical theory of the universe. Save as he seems unwittingly to countenance that, we have then no quarrel with Sir Arthur Rücker.

P.S.—How widely the position and the outlook in physics has altered the reader will appreciate by consulting the late H. Poincaré's recent books, *La Valeur de la Science*, 1905, *Science et Méthode*, 1908, *Dernières Pensées*, 1913.

EXPLANATORY NOTES

PART I

Note i, p. 37.—As E. du Bois-Reymond pointed out, Laplace should have said, "two successive instants."

Note ii, p. 83.—"In recent times not only our belief in the absolute exactness of the law of the conservation of weight has been shaken, but also our belief in the law of the conservation of the elements. . . . We realise once more that no law can be regarded as free from criticism and limitation; in the whole realm of exact sciences there is no such thing as the Absolute." W. Ostwald, *Ency. Brit.*, 11th ed., s.v. Element, ix., p. 258 a. Cf. especially Poincaré, *La Valeur de la Science*, 1905, pp. 194 ff.

Note iii, p. 92.—Since this was written (1895) it has come to closer quarters than was then thought possible, but only to resolve its supposed elemental atom into a constellation of electrons.

Note iv, p. 99.—The experiments which have led Professor J. J. Thomson to propound the hypothesis of 'bodies smaller than atoms' give additional credibility to this supposition of Clifford's. They shew that the number of 'corpuscles' in an atom varies with its electrical state.

Note v, p. 101.—The late Professor Poynting reminded me that Professor Larmor's hypothesis concerning the nature of material elements, the immutable individuality discussed in this paragraph, is not due to substance—as with Maxwell—but to form. It consists of a 'strain centre' that flits from point to point of the ether, different parts of the ether coming into the strain, as that moves about.

Note vi, p. 102.—The phenomena of radioactivity places the decomposition of 'elements' beyond a doubt.

Note vii, p. 108.—Since Huxley wrote this passage, Sir Norman Lockyer has published an interesting little book entitled *Inorganic Evolution as studied by Spectrum Analysis*, 1900.

Note viii, p. 148.—This statement, Professor Poynting told me, must be modified in so far as Laplace was associated with that masterly experimenter, Lavoisier, in investigating specific heat and the dilatation of solids with rise of temperature. But the following sentence confirms the estimate given of him above:—"It was perhaps as much because it threatened an inroad on a cherished generalisation as because it seemed to him little capable of mathematical treatment that the undulatory theory of light was distasteful to him" (*Encyclopædia Britannica*, 9th ed., article *Laplace*, p. 303).

Note ix, p. 167.—This entirely *ad hominem* argument addressed exclusively "to those who are fond of the 'high priori road'" has been mistaken by some of my reviewers and correspondents as intended indirectly to prove that the energy of the universe is necessarily infinite. The position I had in view is comparable to that of a man who should say: Here is an infinity of balls and only one is white. He is invited to draw, and draws white. That fact, I think, should lead *him* to reconsider his statement, but it would not justify *me* in assuming that all the balls are white. It would, however, justify me in supposing the number of white balls to be at least indefinitely great. But I have thought it wiser to disavow such *a priori* arguments altogether. Of (relative) beginnings and endings, within the universe we have experience enough, but of the (absolute) beginning or ending of the universe we have no experience and no conception. Having experienced filled time, we can form the conception of empty time extending indefinitely into the past and into the future, but we have no warrant for treating this as a reality independent of all reality beside.

Note x, p. 169.—On the subject of the Conservation of Energy the reader may with advantage consult Professor Poincaré's *La Science et l'Hypothèse*, 1902. In fact the whole book is to be strongly recommended to all who are interested in the scope and validity of the mechanical theory.

PART II

Note i, p. 186.—In an article on this book (*Fortnightly Review*, Dec. 1899) Mr. Spencer states his essential purpose to be that of 'exemplifying my controversial method,' and concludes by warning his readers that before accepting my version of his views "it will be prudent to verify them." But, strange to say, in a revised edition of his *First Principles*, published in 1900, a large number of the passages on which I have animadverted—passages that had remained unchanged for thirty years—are now silently either suppressed or altered. Only in a brief appendix of some five pages is there any direct reference to this work. There Mr. Spencer begins by saying: "It is half instructive, half amusing to observe what trivial difficulties, and even what imaginary difficulties, are urged by those who seek reasons for rejecting doctrines they dislike." He then dismisses my criticisms with the remark: "Were I to notice all of them at length, half a volume would be required. . . . So far as I have observed, he has throughout followed the course which generally characterises controversy—that of setting up men of straw and knocking them down." Mr. Spencer's readers are thus left to infer that in general he has found it unnecessary to pay any attention to my objections, and the numerous alterations or suppressions of passages, to which I have alluded, will therefore strike them as interesting coincidences. I have indicated some of these in the footnotes given in the text—stereo. ed. referring to the stereotyped editions, and rev. ed. to the revised edition.

In the stereotyped editions Mr. Spencer treated the universe as a single object which is alternately evolved and dissolved, and my first criticism was that the universe cannot be so regarded. Instead of the words "Be it a single object or *the whole universe* any account which begins with it in a concrete form . . . is incomplete" (see p. 181, above), we now find merely "Any account of an object which begins," etc.—no reference to the universe at all; and in like passages elsewhere all reference to the universe is suppressed. Again, in the earlier editions we find Mr. Spencer saying: "It is obvious that we have not acquired all the information within the grasp of our intelligence until we can, in some way or other, express the whole past and the whole future of each object *and the aggregate of objects*"; and then concluding: "May it not be inferred that

Philosophy has to formulate this passage from the imperceptible into the perceptible, and again from the perceptible into the imperceptible?" (stereo. ed., p. 280). He declares "that a Philosophy stands self-convicted of inadequacy" if it fails of such formulation: for "if it begins its explanations with existences that already have concrete forms, or leaves off while they still retain concrete forms; then, manifestly, they had preceding histories, or will have succeeding histories, or both, of which no account is given. And as such preceding and succeeding histories are subjects of possible knowledge, a Philosophy which says nothing about them falls short of the required unification" (stereo. ed., p. 541 *fin.*). In the revised edition all these passages are omitted, and Mr. Spencer, with commendable candour, confesses that they imply an unattainable ideal. "Complete accounts of the beginnings and ends [even] of individual objects," he now allows, "cannot in most cases be reached. . . . Still more, then, with the totality of things must we conclude that the initial and terminal stages are beyond the reach of our intelligence" (rev. ed., p. 256).

But now Philosophy, according to Mr. Spencer's definition, is *completely-unified* knowledge; knowledge partially unified is only Science (§ 37 *fin.*); his theory of evolution, then, on his own showing is not entitled to be called philosophy. Further admissions, pointing in the same direction, will appear presently (see below, pp. 592, 595).

My second criticism was that even regarding the universe as a single object, we are not warranted in saying that "there is an *alternation* of Evolution and Dissolution in the totality of things." Prior to the publication of his revised edition, in the article above mentioned Mr. Spencer complained that in so objecting I had treated a tentative opinion as a positive assertion. "He does not," says Mr. Spencer, "quote the whole clause, which runs thus:—'For *if*, as we saw *reason to think*, there is an alternation of evolution and dissolution in the totality of things, etc.' Here there are two qualifying expressions which he suppresses" (*Fortnightly*, p. 902). But the odd thing is (as I pointed out in "A Reply to Mr. Herbert Spencer," *Fortnightly*, March 1900, p. 469) that even Mr. Spencer himself did not quote his own words without suppression. Here is the passage in full: —"For if, as we saw reason to think, there is an alternation of Evolution and Dissolution in the totality of things—if, *as we*

are obliged to infer from the Persistence of Force, the arrival of either limit of this vast rhythm brings about the conditions under which a counter-movement commences—if we are *hence compelled to entertain* the conception of Evolutions that have filled an immeasurable past, and Evolutions that will fill an immeasurable future; we can no longer contemplate the visible creation as having a definite beginning or end" (stereo. ed., p. 551—italics mine). As one out of many possible passages in which Mr. Spencer seemed to have committed himself to a positive assertion, I also quoted this one: "Thus we are led to the conclusion that the entire process of things, as displayed in the aggregate of the visible universe, is analogous to the entire process of things as displayed in the smallest aggregates . . . now an immeasurable period during which the attractive forces predominating, cause universal concentration, and then an immeasurable period during which the repulsive forces predominating, cause universal diffusion—alternate eras of Evolution and Dissolution" (stereo. ed., pp. 536 f.). Of course Mr. Spencer knows best what he meant to say: his readers must judge how far he succeeded in saying it. At any rate in the revised edition he is clearer, for not only are these and other seemingly positive assertions withdrawn, but it is expressly admitted that "the question whether there is an alternation of evolution and dissolution in the totality of things is one which must be left unanswered as beyond the reach of human intelligence," and even "as passing the bounds of rational speculation" (rev. ed., pp. 506, 492). Once again, then, Mr. Spencer's theory of evolution drops from the level of philosophical synthesis based on "the ultimate datum of consciousness" to the level of science, "unable to trace the entire history even of a small aggregate!" (rev. ed., p. 493). But, in truth, if the appeal is not to that hopelessly vague conception, Mr. Spencer's Persistence of Force as an ultimate datum of consciousness, but to the conservation of energy as commonly understood—and this is what Mr. Spencer usually has in mind—then the question whether there are alternations of evolution and dissolution in the totality of things is not 'transcendental' at all. It is neither to be positively asserted nor to be left in doubt. The energy of the universe is either finite or infinite. In both cases there may be alternations of evolution *within* the universe, but in the one they will come to an end, in the other they will not: in neither will there be such alternations of the universe as a whole.

Note ii, p. 189.—In his article, mentioned in the previous note (*Fortnightly Review*, p. 901 *fin.*), Mr. Spencer contended that he had himself anticipated this criticism before I was out of my teens, and then proceeded to quote a paragraph of his *First Principles* (stereo. ed., pp. 535, 536) in proof. "Unhappily," as I have already said in reply (*Fortnightly*, March 1900, p. 470), "the facts are quite otherwise. Not only are Mr. Spencer's reasons not the same as mine, but they are not reasons against the doctrine of the dissipation of energy at all; though they refer to something that sounds rather like it, viz., to what Mr. Spencer is fond of calling 'the dissipation of motion.' That dissipated or degraded energy means not energy that is 'diffused' or 'radiated' but energy that is no longer available for work, is a point that Mr. Spencer had entirely overlooked. In the revised edition (p. 492) he has amended this paragraph: there is now some mention of energy and of heat, but the result only shows still more conclusively Mr. Spencer's ignorance of thermodynamics. In fact his second version is, if anything, more inaccurate than his first, for he seems to think that the dissipation of energy may be counteracted by maintaining the thermal equilibrium of space.

Of course it is conceivable that the energy dissipated at any time is always a constant fraction of the energy remaining available, so that the process would never end. If we then suppose further, as Professor Poynting has suggested, that "living beings became capable of using more and more minute differences, life might persist as well." This very theoretical possibility the authors of the *Unseen Universe* did not take into account.

Note iii, p. 192.—Mr. Spencer replies that he has nowhere asserted moving equilibrium of the universe, but that on the contrary he has expressly negatived a moving equilibrium of our sidereal system, thereby implying that he would still more definitely negative such an equilibrium of the universe (*Fortnightly*, p. 904).

It is true that the spinning-top is only mentioned to exemplify the *nature* of mobile stability; but not only is the *principle* itself an integral part of the Laplacean hypothesis to which Mr. Spencer's theory of evolution really rests, but his own statement of the principle in the chapter on Equilibration as a manifest deduction from the Persistence of Force is made without any

reservation whatever.[1] In the following chapter dealing with Dissolution, in order to show "that the structure of our galaxy is undergoing change and must continue to undergo change," he refers to its irregular distribution as "being such as to render even a temporary moving equilibrium impossible." But this, even if true, does not affect the existence within our sidereal system of stellar systems, and some of these systems far more complex than our solar system, which are stable in Laplace's sense: indeed the little we know all points this way. To meet Mr. Spencer's criticism it would be enough to say that on his theory the universe consists of an indefinite number of spinning-tops, and that as time goes on the tops collide, tops ever larger in size and fewer in number being the result.

His admirers will be depressed to find that in the revised edition Mr. Spencer has withdrawn the "warrant for the belief that evolution can end only in the establishment of the greatest perfection and the most complete happiness," which he had previously deduced from his *equilibrium mobile.*

Note iv, p. 211.—Mr. Spencer (*Fortnightly*, p. 899) sees nothing but a comment on his mode of writing in this reference to the distinction between Force and force. "Supposing even," he says, "that capitals were in such cases inappropriate . . . only one with a strong *animus* would have gone out of his way to notice it." But obviously my point is that Mr. Spencer's usually correct mode of writing serves to indicate the essential difference between Force as Absolute, which does not, and force as phenomenal, which does, admit of measurement.

The confusions and the inconsistencies of Mr. Spencer's exposition of his fundamental principle are incredible. I have dealt with them at some length in my *Reply* to him (*Fortnightly*, 465-467); I will quote here only my last paragraph:—

"Now I have contended that it is meaningless to apply quantitative notions to an Absolute Force, *alias* Ultimate Cause, *alias* Unconditional Reality, especially meaningless when it is only an Unknowable that 'we are irresistibly compelled by the relativity of our thought to vaguely conceive,' etc. (*F. P.* p. 170 [2]). Moreover, returning to the chapter on Relativity, to which chapter Mr. Spencer himself seems to direct us (cf. *F. P.* p. 91), we find that he, too, allows that it is "impossible to give to this

[1] Cf. especially stereo. ed., p. 516.
[2] Omitted in the revised edition.

consciousness [of the Non-Relative or Absolute] any qualitative or quantitative expression whatever." If now we agree with Mr. Spencer that "definite conclusions can be reached only by the use of well-defined terms," may we not reasonably ask how 'the phenomena of evolution' can be—as he says they 'have to be—deduced from the Persistence of Force,' when this Force turns out to be the Non-Relative or Absolute? (cf. *F. P.* p. 398). For "this non-relative spoken of as a necessary complement to the Relative is not spoken of," Mr. Spencer reminds us, "as a conception but as a *consciousness*; and I have," he continues, "in sundry passages distinguished between those modes of consciousness which, having limits, and constituting thought proper, are subject to the laws of thought, and the mode of consciousness which persists when the removal of limits is carried to the uttermost, and when the distinct thought consequently ceases" (*Essays*, 1892, vol. ii, p. 252). What have we got here more than the bare notion of pure being? How are we going to deduce the 'Instability of the Homogeneous,' or 'Equilibration' from this 'indefinite consciousness of the unformed and unlimited'? How, indeed, save as everything that is, let it be what it may, is implied in an Ultimate Cause and included under the category of Existence? The force of a blow and the force of an argument, nay, any two things whatever, will have their equivalents in this 'pure Force.' But what 'transcends experience' can never be 'the basis of any scientific organisation of experience' (cf. *F. P.* p. 192). Between Force = Ultimate Cause and force = energy Mr. Spencer's cosmic philosophy is, I have contended, bound to fall. But he has not deigned to notice my argument, yet in replying to Mr. Moulton he advances one of these meanings, and in replying to me he advances the other."

Note v, p. 212.—My sole purpose in quoting this passage from Lotze was simply to suggest that a philosopher, who like Mr. Spencer talks freely of 'the Absolute' and of 'rational synthesis,' would have done better not to shackle both with quantitative fetters. Mr. Spencer, however, quotes it (*Fortnightly*, p. 904), italicising 'self-realisation of the idea,' as merely a specimen of my sort of philosophy!

Note vi, p. 216.—In the earlier editions of his *First Principles* Mr. Spencer's philosophy, as a complete unification of the knowable, professes to set before us the evolution of the universe from beginning to end, *i.e.* from the imperceptible to the imperceptible.

"Philosophy has to formulate this passage," for "wherever we now find Being so conditioned as to act on our senses, there arise the questions—How came it to be thus conditioned? and How will it cease to be thus conditioned? . . . Hence our Theory of Things, considered individually and in their totality, is confessedly incomplete, so long as any past or future portions of their sensible existences are unaccounted for."[1] The start accordingly is made with the absolutely homogeneous, since no other state would necessarily be imperceptible, and any heterogeneity would have to 'be accounted for.' But "some rearrangement [of the absolutely homogeneous] must result," Mr. Spencer has said. Certainly there would be no evolution otherwise: so we reach the proposition that "the absolutely homogeneous must lose its equilibrium."

But in the revised edition Mr. Spencer, as we have already seen, drops the universe and omits alike the beginning and the end of the evolutionary process. And now we find that he also parts with the absolutely homogeneous. He makes all these renunciations, however, in a very vacillating fashion, like one unwilling to abandon an ancient domain. Thus, "only at the last moment, when . . . all the rest of the volume is standing in type," he perceives that his "definition of Evolution needs qualifying by the introduction of the word '*relatively*' before each of its antithetical clauses," and in an appendix he gives his reasons for the change (see the Note, rev. ed. p. 367). In the said appendix (App. A) he tells us that "the transformation we call Evolution must be regarded as falling between two ideal limits, neither of which is reached"! (rev. ed. p. 514). Nevertheless he still maintains that "the absolutely homogeneous (*supposing it to exist*) must lose its equilibrium" (rev. ed. p. 397—italics mine). Now since even Mr. Spencer's revised theory of evolution begins with relative homogeneity—and instability, and ends with relative heterogeneity—and equilibration, one might suppose that the instability of the absolutely homogeneous—or the ideal initial limit—was still inferred from his empirical formula. If, proceeding forwards, "the relatively homogeneous must lapse into the relatively less homogeneous"—and this is still maintained—then surely, regressing backwards, the relatively less homogeneous must arise from the relatively more homogeneous, and so the absolutely homogeneous, absolutely unstable, might still be regarded at least ideally as the beginning of

[1] Stereo. ed. pp. 278-280.

evolution. How else are we to interpret the two extremes between which all evolution lies—indefinite, incoherent homogeneity, with potential energy a maximum, and definite, coherent heterogeneity with all the energy dissipated? But such an interpretation Mr. Spencer, it seems, never intended, and now emphatically disavows! "No special instability," he now maintains, "characterizes the homogeneous"!! By way of emphasising this still further he has even amended the title of the chapter in which he expounds this principle; it is now headed, The Instability of the Homogeneous, *exemplifying Instability at large*, and the principle itself is reduced to "a corollary from the truth that change is universal and unceasing" (App. A, p. 515). But we are now at a loss to know why "the more homogeneous must tend ever to become less homogeneous," and the 'lapse' in the opposite direction be an impossibility. We are well aware, of course, that there are instances in plenty of changes in both directions, when only parts of the universe are regarded—even what to us are very large parts; but Mr. Spencer's philosophy still implies that for the universe as a whole in its evolutionary phase the change is only in one direction. He still speaks of the instability of the homogeneous as "one end of the series of metamorphoses," and because of "the universality of this perpetual increase of structure" finds it "requisite to begin with the structureless" (App. A, p. 516). On the whole Mr. Spencer now leaves us more puzzled than ever to find any necessary connexion between "those traits which celestial bodies, organisms, societies, alike display" and "instability at large." It is a long step from such instability, or "the truth that change is universal and unceasing," to "the one increasing purpose" which evolution implies. The most effectual refutation of Mr. Spencer is surely here supplied by himself!

Note vii, p. 221.—Mr. Spencer, of course, cannot accept what he is pleased to call my "dictum respecting the utterly unscientific and unphilosophical phrase 'indefinite incoherent homogeneity.'" But the only reply he makes to my reasons for this '*dictum*' is to ask whether it is not proper to describe an egg as more homogeneous than the chicken which evolves from it. The egg is a great stand-by of Mr. Spencer's: he has hurled it against opponents more than once before. But here it altogether misses the mark: so far as his attack is relevant, I will try to rebut it presently. The immediate question, however, is the

meaning of 'indefinite, incoherent homogeneity.' I maintain it to be meaningless, and it is for Mr. Spencer, if he can, to point out a case in which it is not. An egg, even if regarded as homogeneous, is not, from the standpoint of the synthetic philosophy, such a case; and what is more important, a nebula also is not. In terms of matter and motion, both are perfectly definite in configuration and dynamically coherent—no part can move independently of the rest. And coming now to Mr. Spencer's question, I reply that from the standpoint of his theory it is not proper to describe an egg as more homogeneous than the chicken which is hatched from it. Both are but different arrangements of the same elements as truly as *Bceeeehnprrrst* and *Herbert Spencer* are but different arrangements of the same letters. It may be easier to halve the egg than to halve the chicken, but to dissipate the egg into the imperceptibility of matter primeval would be as hard as dissipating the chicken: both in that respect are equally far removed from the structureless.

Note viii, p. 223.—Dr. Venn (*Empirical Logic*, p. 109) had, I find, already called attention to the weakness of Mr. Spencer's argument here.

Note ix, p. 226.—In his revised edition Mr. Spencer devotes two closely printed pages to this paragraph. Some of his points in this defence have been already incidentally dealt with in the preceding notes. But there are one or two others that call for some reply. "I might urge," he begins, "that since the law of evolution, as everywhere represented by me, is a law of the re-distribution of matter and motion within sensible aggregates, and not as a law of re-distribution within their insensible molecules, it might suffice for its establishment were it proved applicable to the first without taking any note of the last" (rev. ed., App. C, p. 535). He then objects that I have "ignored entirely the distinction between simple and compound evolution,"[1] and explains that the latter is only possible when the process of evolution is slow, and when "there continues a partial mobility among the concentrating units." "Ignoring this fundamental distinction, Professor Ward," he says, "has assumed that chemical units are aggregates, which can present this secondary re-distribution; whereas, as he knows, they are

[1] But cf. pp. 207-209, above.

aggregates suddenly formed, and, *if considered as evolved*, can exhibit only that simple evolution seen in the integration of matter and dissipation of motion: *the contrast between homogeneity and heterogeneity cannot arise*" (rev. ed., p. 535—italics mine). For my part, I must disclaim this 'knowledge' with which Mr. Spencer credits me: I fancy every school-boy knows better. Has Mr. Spencer, we wonder, forgotten the difference between old wine and new, or Nature's slow elaboration of the juices of fruits and the scents of flowers? Have starch, sugar, albumen, no history? In particular, if molecules never retain 'a partial mobility among their concentrating units' what becomes of Mr. Spencer's ingenious theory concerning 'certain specific molecules' which he has called 'physiological units': and if they exemplify simple evolution merely, what was to fill the two missing volumes devoted to pre-organic evolution? Nay, if it be a question whether chemical units are to be 'considered as evolved,' and if evolution, as everywhere expounded by Mr. Spencer, is a law applicable only to sensible aggregates and not to their insensible molecules, is there anything missing in the Synthetic Philosophy after all? But then how came Mr. Spencer to say: "The evolution of the elements, if not systematically dealt with within the limits of the Synthetic Philosophy, has not been ignored. In an essay on 'The Nebular Hypothesis' five groups of traits are enumerated which support the belief that they originated by a process of evolution like that everywhere going on" (*Fortnightly Review, l.c.* p. 900)?

Note x, p. 229.—In this criticism, again, it has been pointed out to me that I have been anticipated. Cf. Mr. F. H. Bradley's *Principles of Logic*, p. 496.

Note xi, p. 262.—My attention has been called to an emendation of the passage here quoted, which Mr. Spencer has introduced into the third edition of his *Principles of Psychology*. In place of the last clause: "there must result an unbroken series of these changes—there must arise a consciousness"; we now have: "there must result an unbroken series of these changes, the subjective face of which is what we call a coherent consciousness." And whereas in the earlier edition the passage quoted was continued thus: "Hence the progress of the correspondence between the organism and its environment necessitates a gradual reduction of the sensorial changes to a

succession; and by so doing evolves a distinct consciousness—a consciousness that becomes higher as the succession becomes more rapid and the correspondence more complete"; in the new edition we have instead the following: "Of course I do not mean that material actions thus become mental actions . . . I am merely showing a *parallelism* between a certain physical evolution and the correlative psychical evolution." But such patchwork corrections are surely futile. As Professor James incisively remarks, the passage withdrawn "resembles too many others in his *Psychology* not to be taken as a serious attempt to explain how consciousness must at a certain point be 'evolved.' That when a critic calls his attention to the inanity of his words, Mr. Spencer should say he never meant anything particular by them, is simply an example of the scandalous vagueness with which this sort of 'chromo-philosophy' is carried on" (W. James, *Principles of Psychology*, i. p. 149).

Note xii, p. 269.—"If I had to rewrite my book, I would use 'natural preservation' or 'naturally preserved.'" *More Letters of Charles Darwin*, i. p. 161.

Note xiii, p. 273.—In spite of this reference to an 'imposing array of facts' in support of the Lamarckian theory, I have not, it is urged, "mentioned any fact which indisputably proves the theory." Obviously, if any such crucial instance had been forthcoming there would have been an end of the controversy between Neo-Lamarckians and Neo-Darwinians, which still continues. And so there would equally have been an end of it had the Neo-Darwinians been able to prove indisputably that the inheritance of acquired character is an impossibility. Moreover, it would be fair to retort that they, on their side, are unable "to mention any fact which indisputably proves the theory" of Natural Selection, although there is an array of facts still more imposing which support it. Both theories are in this respect on a par; their evidence is cumulative, not demonstrative, and, as said in the text, they are not incompatible, but complementary. In fact, the strain thrown on Natural Selection reaches the breaking-point when it is left to work exclusively on fortuitous variations. Hence both principles were maintained not only by Darwin himself, but by all evolutionists, with the single exception of Wallace, till Weismann appeared upon the scene. But Darwin and the earlier naturalists had assumed that the germ is the direct product of the parent organisms

and elaborated *de novo* in each generation. The inheritance of acquired characters seemed to be the natural inference from such an assumption. But when about 1874 the hypothesis of germinal continuity began to find favour with biologists, the difficulties in the way of the older conception of heredity were materially increased.[1] And when in 1885 Weismann maintained the *absolute* continuity of germ plasm, the transmission of somatic modifications became impossible, supposing the new hypothesis to be sound. Meanwhile, 'the imposing array of facts' on which the Neo-Lamarckians lay stress still remains. It is still true, as one of them has said, "that transformation, whether in the way of the addition of new parts or the reduction of those already present, acts just *as if* the direct action of the environment and the habits of the animal were the efficient cause of the change, and any explanation which excludes the direct action of such agencies is confronted by the difficulty of an immense number of the most striking coincidences."[2] Quite apart from this truly formidable difficulty that the Neo-Darwinians have taken upon themselves, very weighty objections have in recent years been accumulated from many sides against the theory of Natural Selection even as restricted by Darwin himself; and while there are not a few naturalists who have gone the length of rejecting it altogether, the majority, though they avoid this unwarrantable extreme, seem to allow that its range, so far from covering the facts to which the Neo-Lamarckians appeal, must be further restricted still. Thus, if it be true that on the one hand the further study of heredity has tended to invalidate the Lamarckian theory, it is equally true on the other that palæontology and the general progress of biology have equally tended to discredit Natural Selection as the sole and sufficient theory of biological evolution.[3] The present situation is admirably summed up in the following 'perfectly correct conclusion,' as Weismann terms it, of Professor H. F. Osborn:—"If acquired variations are transmitted, there must be some unknown principle in heredity; if they are not transmitted, there must be some unknown factor in evolution."[4]

[1] See Prof. J. A. Thomson's excellent little book, *The Science of Life*, pp. 146 f.

[2] W. B. Scott, *Am. H. of Morphology*, 1895, p. 395.

[3] I mean by Natural Selection here what Darwin meant: the wider range given to it by Roux, Weismann, and others is referred to in Note xvi., p. 605, below.

[4] Weismann, *Germinal-Selektion*, 1896, p. 26.

Note xiv, p. 279.—For illustrative instances see the Evening Lecture on "The Movements of Plants," delivered at the Glasgow meeting of the British Association, 1901, by Francis Darwin, F.R.S., reported in *Nature*, vol. lxv. p. 40; also (by the same author) "The Statolith Theory of Geotropism," *Nature*, vol. lxvii. p. 571; also *Sinnesorgane in Pflanzenreich zur Perception mechanische Reize*, by Professor Haberlandt, 1901.

Note xv, p. 288.—Modern theories of biological evolution bristle with 'selections' of divers sorts. But in every case there must be what we may call an agent or activity selecting as well as material from which the selection is made; and no doubt should be left which is meant. In the so-called 'organic' selection of Professor Baldwin and others, organs are neither what selects nor yet what is selected; and inasmuch as the latter alternative holds good in the famous theory of W. Roux, to which the term 'organic selection' had accordingly been already applied,[1] the use of the same term in a widely different sense is unjustifiable, even were it otherwise fitting. But in this miscalled organic selection it is the whole organism or living individual that selects, and so far the new principle is entirely in line with what I have called subjective selection. But organic selection includes not only those modifications which are due to 'conscious selection,'[2] but also those due to changes of food and climate, already described by Darwin in his chapter on the Laws of Variation, and referred by him to the plasticity of the organism. Subjective or conscious selection would have some share in producing even these modifications, and would have more the more highly organised the individuals concerned.

But though organic selection and subjective selection so far coincide at the outset, they differ in the end. According to the latter, what is selected is a specific environment. And here I must digress for a moment to acknowledge, as Sir Francis Darwin has pointed out to me, that my views were largely anticipated in what his father has described as 'divergence of character' and speaks of as 'a principle of high importance' (*Origin of Species*, 6th ed., pp. 86-90). The chief difference, and not, I think, a slight one, is that Darwin seems to have regarded divergence of character as a *result* of natural selection, whereas

[1] By Delage, *Structure du Protoplasma et les Théories sur l'Hérédité*, 1895, p. 732. Weismann uses for it the almost equivalent term, 'histonal selection,' *Germinal-Selektion*, 1896, p. 60.

[2] Professor Lloyd Morgan's term.

I have regarded it as independent of, co-ordinate with, and in a sense antithetic to, natural selection. The motto of the one seems to be, "The devil take the hindmost"; that of the other, "Peace and good-will." But if on my view the organism selects its environment, what does it select on the view of Professor Baldwin and his friends? Directly nothing at all: hence a sub-title, "Organic (or Indirect) Selection."[1] No doubt here, too, a specific environment is selected. This fact is not denied; on the contrary, under the name of "accommodation" it is described at length—especially by Professor Baldwin—down to the minutest details, in entire accordance with the psycho-genetic analysis long beforehand put forward by me.[2] But the stress of the new theory is not here. What it specially emphasises is the selection of congenital variations, coincident with or correlated to the modifications acquired during individual accommodation. It is argued, soundly enough, that in the course of generations of individuals surviving through the superior fitness that such accommodations secure, congenital variations—and such are constantly arising—which concur with the acquired modifications will increase, while those that conflict with them will diminish, the chances of survival. In the one case the 'selective values' concerned may be represented by $m + v$, in the other by $m - v$. Thus for the race the acquired characters have a *directive tendency* on the course of evolution both positively and negatively. But even so it is not the series of organisms but Nature that *directly* selects; and the inappropriateness of the term 'organic selection' is thus again apparent. This "unfortunate title," as Professor J. Arthur Thomson has called it, really hides what is so far the main point of its authors, viz. 'determinate evolution,' or 'orthoplasy,' as they also term it—evolution, in other words, not by means of fortuitous variations, but by means of variations definitely singled out for natural selection by the character of the specific environment to which the individual accommodates. This is an obvious but important corollary from the principle of subjective selection, to which I had myself referred, though briefly and, I must own, obscurely enough (cf. above, p. 293 *fin.*). All the credit on this point I yield entirely, so far as I am concerned, to the writers in question.

So far the advocates of organic selection are thoroughly at

[1] Baldwin, *Development and Evolution*, p. 173, note.

[2] Save that, as already said, besides such psychical accommodation, physical accommodations are also included

one with the Neo-Lamarckians in recognising the necessity of teleological factors, and are opposed to the Neo-Darwinians, if there still are any, who contend for the sufficiency of natural selection of fortuitous variations. And this necessity will remain whether acquired characters are or are not regarded as directly transmitted. But these writers believe that organic selection enables them to dispense with the Lamarckian law of use-inheritance accepted by the older Darwinians. And this, they consider, constitutes the great merit of their principle.[1] "This hypothesis, "*if it has no limitations*," says Professor Osborn, "brings about a very unexpected harmony between the Lamarckian and Darwinian aspects of evolution. . . . While it abandons the transmission of acquired characters, it places individual adaptation first, and fortuitous variation second, as Lamarckians have always contended, instead of placing survival, conditioned by fortuitous variations, first and foremost, as selectionists have contended."[2] As I have said, this is in any case an important result. But has the hypothesis "no limitations"? Is it an adequate substitute for the Lamarckian principle of use-inheritance? That it would be effective in promoting determinate evolution up to a certain point will, I think, be generally allowed. Congenital, *i.e.* germinal, variations, it must be remembered, are still supposed to arise fortuitously and independently. Suppose a single variation, say in the *plus* direction, to be advantageous, its occurrence in this direction in many individuals and in the *minus* direction in about as many others might be expected before long, and both events would tell on the evolution of the race. But whenever a complex of many simultaneous variations was requisite, the chances would be greatly against the right combination occurring in *any* individual—to say nothing of many; usually one variation in the right direction would be neutralised in the same individual by another in the wrong: in a word, the old difficulty of co-adaptations would, to a large extent, still remain. Possibly the screening effect of the acquired modifications might do something to sustain even a single variation of such a complex till a second arose, and so on. But surely this is very problematic. Of course, the final appeal is to facts; and no doubt those biologists

[1] In this Professor Lloyd Morgan, whose exposition is decidedly the best, admits that the idea was first suggested to him by Weismann's Romanes Lecture. See Baldwin, *Development and Evolution*, App. A, pp. 342, 348.

[2] Baldwin, App. A, p. 339. Italics mine.

are right who, weary of speculation, insist on confining their attention to them.

Note xvi, p. 294.—Within the last six or seven years—and particularly in his latest book on *Germinal Selection as a source of determinate variation* [1]—Weismann has amply redeemed his promise to deal with the questions of co-adaptation and the transmission of functionally-produced modifications. To the surprise of everybody he begins by admitting that after all "the Lamarckians were right in maintaining that what has so far *alone* borne the denomination of Natural Selection is inadequate to explain the phenomena." "Something is still wanting to the Selection of Darwin and Wallace. . . . There is still a hidden secret to be discovered." The selection of accidental variations will not suffice: a "*profounder connection must exist between the utility of a variation and its appearance*, or in other words, *the direction of the variation of a part must be determined by utility.*" To Darwin's 'personal selection,' as Weismann calls it—or the selection of individuals brought about by their struggle for existence,—to Roux's "histonal selection," due to the struggle for food and room of parts within the organism, there must be added 'germinal selection,' the result of the struggle for food among the biophores, determinants, etc., which on his theory constitute the germ. So confident is Weismann of the sufficiency of natural selection, *when thus extended*, that he indulges the hope of a speedy reconciliation and amalgamation of the hitherto conflicting views; accordingly he holds out the olive branch to his quondam opponents and invites them to join with him in building further on the newly-laid foundation. So far the invitation has met with no response. The general attitude of biologists towards Weismann's work is fairly represented in the following conclusion of one of his ablest and most impartial critics:—"Nous croyons avoir montré qu'il est bâti d'hypothèses fragiles, invraisemblables, et, tout en rendant justice au talent de son architecte, nous conseillons de l'admirer de loin et de construire ailleurs" (Delage, *Structure du Protoplasma*, etc., 1895, p. 837).

Note xvii, p. 296.—I have attempted to deal further with some of Weismann's view in a lecture entitled *Heredity and Memory*, 1913.

[1] *Ueber Germinal-Selektion, eine Quelle bestimmt gerichteter Variation*, 1896. There is an American translation by T. J. M'Cormack.

PART III

Note i, p. 324.—Wundt, in fact, rejects both dualism and materialism, and regards parallelism as entirely confined to the recognition of the empirical concomitance of *psychosis* and *neurosis*.

Notwithstanding what is said in the text, I have been supposed by some critics (cf. *e.g.*, Mr. H. R. Marshall in *Mind*, 1902, p. 487 *n.*) to reject the 'methodological' use of parallelism which is there described. Quite the contrary. Cf. also pp. 329, 387. I have dealt with this point more fully in the article *Psychology*, *Ency. Brit.*, 11th ed., vol. xxxii. pp. 66-9.

Note ii, p. 332.—The reader interested in Mr. Spencer's philosophy will do well to compare the more guarded statements in the revised edition of his *First Principles* (§ 71 c) with what he had said in the earlier editions (stereo. ed., § 71, pp. 217 f.) concerning the metamorphosis of physical force into feelings, etc. "The only supposition having consistency," he now thinks, "is that that in which consciousness inheres is the all-pervading ether!" "This, however," he adds, "is but a semblance of an explanation." Verily. "Such an explanation," he continues, "may be said to do no more than symbolise the phenomena by symbols of unknown natures"! Anyhow, Mr Spencer is with us in condemning the conscious automaton theory, and that is something.

Note iii, p. 357.—Professor Ritchie[1] asks: "May not the universe be both at once, through and through mechanical when regarded in its material and spatial aspect, teleological when regarded in its spiritual aspect . . . . ?" Unquestionably, provided the teleological be regarded as ultimate and supreme, provided too we are not asked to accept an irresolvable dualism of material and spiritual. That the mechanical aspect in itself, if it is real at all, must be thorough-going is precisely the position frankly accepted in the text. Again, the facts (1) that the teleological is there, and (2) that the mechanical scheme can find no place for it, are precisely our reasons for concluding that the mechanical theory cannot be either ultimate or supreme. Professor Ritchie's own conclusion, that "the ultimate reality of all things animate and inanimate is their meaning for the one mind which *is* the universe in its inner aspect," is, as he surmises, 'not very different from' ours.

[1] *Nature and Mind*, in the *Philosophical Review*, vol. ix., 1900, p. 264.

Note iv, p. 362.—"As though a coat could be *fitted* to the man without the man fitting the coat, or a scheme 'be devised to describe' the real world without 'applying' to it!" exclaims Professor Perry (*Present Philosophical Tendencies*, 1912, p. 96). But suppose there is a *misfit*,—and such things are not unknown, I imagine, even in Boston,—is the man to be altered or the coat? And are not schemes *devised* to apply without in fact applying as often as coats are made for men without actually fitting them?

Note v, p. 363.—Cf. the reference to Poincaré's *La Science et l'Hypothèse* (above, p. 586) in support of this statement.

Note vi, p. 379.—This very illustration was used by Rindfleisch in 1895, a year before this lecture was written. So I learn from Pauly's *Darwinismus und Lamarckianismus*, 1905, p. 150.

Note vii, p. 387.—One of my reviewers[1] regrets that in this discussion of Psychophysical Parallelism I have not dealt with "more recent phases of the controversy, in which criticism of the parallelistic theory has been undertaken by such writers as Busse, Rickert, Wentscher, Erhardt, and others." But the controversy to which reference is made did not begin till after these lectures were delivered! Still I do not find anything to retract, and I find much that I have said confirmed. A more detailed discussion would be unsuitable in a work like the present. For this the reader may consult the *Zeitschrift für Philosophie und phil. Kritik*, 1898-1900.

PART IV

Note i, p. 427.—This statement—that 'one essential of spatial perception is voluntary movement'—leads one of my reviewers (*Nature*, vol. 62, 1900, p. 26) to question 'the quality' of my idealism, and to ask "where does he get the 'voluntary movement'?" I am far from clear as to the precise point of this criticism. It is just possible that in the reviewer's opinion voluntary movement psychologically implicates the experience of space, whereas in my opinion such movement is but one factor in this experience, and what I have called extensity differentiated

[1] Professor Wenley, *Psychological Review*, 1901, p. 298.

into local signs is the other, equally essential, factor. But I have dealt with the psychological analysis of spatial experience at sufficient length elsewhere. Cf. the article *Psychology*, *Ency. Brit.* 11th ed. vol. xxii. pp. 565-7. On 'The Sensation of Movement,' cf. W. James, *Principles of Psychology*, ii. pp. 171 ff.

Note ii, p. 438.—The discussion commencing on p. 135 and here brought to a close has been referred to[1] as if its main purpose were to refute Kant's theory of space. Accordingly it has been condemned as an *ignoratio elenchi*, because with Kant '*a priori*,' it is said, is used always in a logical sense, whereas in this discussion psychological priority is meant. The critic incidentally allows that "Kant mixes up a great deal of psychology with his logical analysis of knowledge." Unfortunately the critic has not seen that it is just this psychology of Kant with which the present argument is primarily concerned. Moreover, it implies an altogether false view of Kant's thought to speak of the psychologically 'innate' as merely 'mixed up' with the epistemologically '*a priori*.' Kant's *a priori* has everywhere its psychological side, and is so far one with the Leibnizian innate; most of all is this true of his forms of intuition, pure space and time. And whereas, according to him, these forms lie ready in the mind ('im Gemüthe *a priori* bereit liegen'), movement and change are altogether *a posteriori* and empirical. In opposition to this it is maintained in the text that the experience of movement and change precede any knowledge of space and time, and are essential constituents of such knowledge. But the question is too technical and extensive for discussion in a work like this. Volumes of controversy have been already devoted to it. For full details the curious reader may consult Vaihinger's *Commentar zur Kant's Kritik*, Bd. ii., 1892.

Note iii, p. 461.—Cf. Lect. xx. p. 570.—My second series of Gifford Lectures, entitled *The Realm of Ends, or Pluralism and Theism*, 2nd. ed., 1912, is an attempt to deal more adequately with this topic.

Note iv, p. 464.—What is here said of Introjection has been criticised by Dr. G. Galloway (*Mind*, 1903, pp. 60 ff.) and by Professor Norman Smith (*Mind*, 1905, pp. 154 ff.). With the former I agree that introjection implies a somewhat developed stage of animism, and in one place or another I have, I believe,

[1] D. G. Ritchie, *Nature and Mind*, in *Phil. Rev.* vol. ix., 1900, pp. 246 f.

anticipated his objections on this point. But the criticisms of the latter seem to me to rest on misunderstandings both of Avenarius and of myself. It may be true enough that "subjective idealism was first definitely formulated in the time of Descartes"; the conception of *species sensibiles*, however, which is as old as Democritus, was quite enough to start the fallacy of introjection if it had not been started before.

Note v, p. 470.—At the outset of this discussion it behoves me now to try to obviate a misunderstanding which I did not at first anticipate. In spite of the constant reference to Kant the mention of two pairs of subjects and objects has led to misapprehension such as the following:—"Professor Ward then presents us with two orders of duality in unity—the individual subject and object indissolubly joined together, and the universal subject and object—the latter being Nature and the former God. This is his way of approaching the theological question, and it is closely related to that of Hegel"! In point of fact I am here concerned neither with a universal subject nor with a universal object, but with universal experience, 'Experience with a capital E, the common empirical knowledge of the race' (p. 444). It is, however, quite true that Nature is the object of this experience. But the subject of it is not God but any individual, who through intersubjective intercourse advances to the stage of self-consciousness and reason; and so, transcending the limits of individual perceptual experience, attains to a knowledge of Nature or the transsubjective. The reference to two orders of experience seemed the fairest way of setting about the problem of establishing this continuity, which certainly could not be taken as granted. For, on the one hand, naïve realism or dualism implicitly denied any subjective factor in the higher of the two; and, on the other, while rationalism completely separated the first from the second, even Kant failed to make clear their organic unity. Further, this initial distinction of the two implied one way or other in both forms of dualism, this sharp contrast of individual and universal, perceptual and conceptual, brings out the difficulty of the problem:—How can experiences so distinct be organically continuous? On this see next note.

Note vi, p. 475.—Rationalism recognised, that is to say, the *de facto* unity of mind and body and the sensory experience that this accident (or miracle) entailed on the mind as *res completa*. But the two kinds of experience—if sentience could be called

experience—remained essentially distinct, not continuously connected.

Note vii, p. 488.—The validity of the argument by which, as I supposed, this conclusion is reached has been challenged by several of my reviewers and correspondents. First it is said that no transition is possible from a strictly individual experience,—that such an experience is by definition solipsistic, and so must ever remain. Again it is said that since "perceptions without conceptions are blind," a purely perceptual experience can never cure its own inherent defect and become conceptual. In other words, if universal, conceptual experiences are verily a development of experiences originally individual and perceptual, then they must obviously in some way have been implicit in these from the first. Assuredly: not only do I admit this now, but it has been all along an essential part of my argument. The best reply to my critics is therefore to recall the relevant points in this; only premising that I have never taken the absolute disjunction as a fact, but found it already confronting us as an assumption—the very assumption, forsooth, that I am mainly concerned to refute.

Those epistemologists who contrast individual experience as subjective with universal experience as objective usually accept the definition—widely current in psychology—of sensations as subjective modifications. I, on the contrary, have contended that for individual experience, for psychology, our so-called 'sensations' are not subjective, not 'feelings,' but objects, or rather changes in an objective continuum, environment or non-ego. If an experience consisting wholly of subjective modifications was a possible one, it would certainly at first sight seem that it would inevitably be and remain solipsistic. It was this apprehension, in fact, that led Reid, as he tells us,[1] to abandon the Berkeleian philosophy. But further reflexion might, I think, convince us that—as I have said elsewhere—"If experience were throughout subjective, not merely would the term subjective itself be meaningless, not merely would the conception of the objective never arise, but the entirely impersonal and immanent process that remained, though it might be described as absolute becoming, could not be called even solipsism, least of all real experience."[2] Or, as Dr. Caird, in a letter to me, still more

[1] *Intellectual Powers*, Hamilton's edition, pp. 283, 285.

[2] *Ency. Brit.*, 11th edition, vol. xxii. p. 549. Perhaps I may be allowed to refer to this article for a fuller treatment of the points raised in this note.

concisely puts it: "If we start with mere sensation as feeling, it is as much a problem *how* we get *into* ourselves as how we get *out* of ourselves." But if even individual experience involves both subject and object, both ego and non-ego, both self and other, it is so far not solipsistic. Moreover, not only has every ego its correlative non-ego,[1] but these several non-egos are not mutually limited and conterminous like the cells of a hive. We may regard every non-ego or objective continuum in Leibniz's fashion as the universe mirrored from a single standpoint. In other words, two individual experiences are only mutually exclusive as regards their standpoints, not as regards boundaries. Within a certain range all is idiosyncrasy,—idiomorphic, so to say. Two men can never share the same organism, and what one eats the other must go without. But as the range of each extends in *ways* that I have already described,[2] mutual recognition, the indication of objects of mutual interest, and the communication of comparisons mutually verifiable, become possible; to the idiomorphic is added the anthropomorphic, which both can share and by which both may gain.

All this, of course, implies what I have called 'intellective synthesis,'[3] and here we are met by the second objection, that a purely perceptual experience is 'blind.' To this, I think, the best answer is that a purely conceptual experience is 'empty.' Again I have to urge that I have never taken this absolute disjunction of sense and thought as valid: on the contrary, this, too, is part of the dualism I am seeking to refute. That such dualism of 'empirical' and 'rational' is not absolute is shown by the fact that the human race has transcended it, and the process is nowadays psychologically, and in the main, perfectly plain. As we have grounds for rejecting the old doctrine of sensations as merely passive impressions, so we have grounds for denying that these are passively built up into complex perceptions by a quasi-mechanical process of association. As I have said (pp. 478 ff.) the genetic treatment of psychological problems was not in the air in Kant's day, and this fact—considering his rationalistic bias—makes his doctrine of a pure synthesis of imagination mediating between sense and understanding all the more striking, though it cannot be called adequate.

A third objection calls for notice. One of my ablest reviewers

[1] Cf. p. 459 f. above, and *Ency. Brit. l.c.*
[2] Cf. preceding reference.
[3] P. 456 above.

suggests that I have derived the higher form of experience from the lower by a process of abstraction.[1] I do not think this objection will be upheld by any reader who does not overlook both my criticism of Kant's derivation of the categories and my own derivation of them—as "new *fundamenta*, realities such as could never dawn upon isolated, perceptual experience"—from self-conscious activity (pp. 481 ff.).

PART V

Note i, p. 534.—Mr. Bradley's words in full are: "What is the content of activity as it appears to the soul at first, in distinction from it as it is for an outside observer, or for the soul later on?" He seems to think that I have unawares made controversial capital out of this omission of the later clause.[2] I confess I did not see that this omission was any gain to my case, nor indeed do I see it now. My whole point was, and is, that the psychological method implied in raising such a question at all rests upon an entirely false conception of experience. Activity, as I understand it, does not first arise within an experience—till then devoid of it—as 'an appearance to the soul.' Experience, I must still maintain, cannot be wholly resolved into cognitive content: in order to knowing there must be being, and in spite of Mr. Bradley's questionings I also still maintain that "apart from activity there is no being at all." See next note.

Note ii, p. 537.—Objections, partly psychological, partly philosophical, have been urged by Mr. Bradley and others against the views of activity here maintained.

Mr. Bradley contends that though I claim to be in possession of the idea of activity, I have not accounted for the possession, but rather have sought to get rid of this problem by 'distinguishing between the fact of activity and our consciousness of the fact.' Activity I regard as a constituent of all experience whatever, and the *idea* of activity as the exclusive possession of self-conscious experients. To account for this possession is then to trace the development of self-conscious or universal experience from mere conscious or individual experience. This, I think, has been done sufficiently for the purpose of my

[1] Professor Ritchie, *Phil. Rev.* ix. p. 265.

[2] *Some Remarks on Conation*, in *Mind*, N.S., 1901, vol. x. p. 450.

argument and as fully as my limits allowed. I have certainly dealt very summarily with Presentationism, the theory on which, so far as I understand him, Mr. Bradley relies to explain this development. But Presentationism (or Intellectualism) has been so often found wanting that I felt justified in ignoring it here; moreover I had discussed it at some length elsewhere.[1] I had also long ago tried to deal with Mr. Bradley's views on this topic (cf. *Mind*, xii., 1887, pp. 62-67, 564-575). In the last three volumes of *Mind*, Mr. Bradley has developed his doctrines concerning practical experience in a very masterly way, and the controversy which I have no doubt will follow the completion of his exposition can hardly fail to remove the scandalous neglect of this subject of which he has so long complained. His recent papers have caused me many heart-searchings, and it distresses me greatly to have to confess that I have not so far been able to find any common ground from which I for my part could profitably resume the controversy, though I suppose it will be my duty to try.

But "however much activity is 'a fact of experience,' a question," Mr. Bradley urges, "may still be raised as to the ultimate truth and reality of activity." I admit this, in so far as I must admit that 'ultimate truth and reality' are altogether beyond us; but I do not admit that there is anything within our experience or reached by reflexion upon it that is more true and real than activity. Mr. Bradley concludes his *Appearance and Reality* with the words: "Outside of spirit there is not, and there cannot be, any reality, and the more that anything is spiritual so much the more is it veritably real." I am content to abide by this.

The sort of question as to ultimate reality, which Mr. Bradley perhaps had in view, is actually raised by Prof. A. E. Taylor in his able review (*Mind*, 1900, ix. p. 258): "In fact (he says), there is no environment for an ultimate and universal mind to act against, and thus, if 'God' is really all and mechanism nothing, 'God' can be neither active nor passive." That is, if there were an independent environment or mechanism for God 'to act against,' he would be active only in our sense; he would be a mere demiurge confronted by matter and simply shaping it; and so we should have dualism *in excelsis*. But surely the old Aristotelian and Leibnizian conception of *actus purus* will carry us beyond this, yet

[1] Cf. '*Modern*' *Psychology*, in *Mind*, N.S., ii. 1893, pp. 54-82.

without making divine activity illusory. But now comes another difficulty: "If the real world of minds should prove to be an anarchic realm of independent and conflicting purposes, both activity and passivity would no doubt be ultimate characteristics of it." In other words, we should then have the finite God of J. Stuart Mill and certain of our contemporary theologians, and what then would become of the divine *actus purus*? "But if, on the other hand, it (the real world of minds) is an orderly system manifesting the guidance of a single intelligence . . . then there are really *no* conflicting purposes and no real failures. . . . The 'consciousness of activity' can only arise from an illusory belief in an antagonism that does not really exist." The seeming opposition by which we are here confronted doubtless calls for mediation. But we shall make a sorry beginning if we abandon the reality of our own activity, though that entails the reality of conflict and failure too. And though anarchy and government are incompatible notions, it is not certain that finite freedom cannot co-exist with divine sovereignty. To me at least it does seem certain that both imply real activity.

Note iii, p. 571.—*The contingency is not that of chance but that of freedom.* "This very scholastic distinction between two kinds of contingency is not," said the late Professor Ritchie, "further explained. The assertion of contingency 'in the very heart of things' seems to imply a real absolute contingency, and not merely a name for our ignorance when the causes are very complex."[1] I cannot admit either that the distinction in question is fairly chargeable with that excess of subtlety which the epithet 'scholastic' implies, nor yet that it is not further explained. On the contrary, it must be plain to the dullest that 'real absolute contingency,' the purely fortuitous, is incompatible both with the universal order which we strive to *conceive* as a system of laws, and with the concrete drama of history—*die Weltgeschichte als das Weltgericht*, to use Schiller's striking phrase—which, as 'one increasing purpose' we strive to *understand*. It is plain again that the historical is not incompatible with natural laws, if these are rightly understood. And yet—such at least is my contention, and has been all through—the historical is not to be reduced to or deduced from such laws. Several reasons for this are, I think, clearly indicated in the

[1] *Philosophical Review*, 1900, p. 263.

immediate context, and are more fully—though, for lack of space, inadequately—elaborated in the earlier lectures.[1] First, science deals with the abstract and conceptual: history with the actual and concrete. It is not '*the complexity of causes*' that separates the one from the other, leaving the historical as an incommensurable remainder with which we in our ignorance are incompetent to deal. It is the efficiency and individuality of the causal agents that history recognises, and science repudiates, which make the essential difference. Secondly, science postulates necessity: history presupposes freedom in the choice of ends. Lastly, this conception of ends introduces us to a new group of categories—the categories of worth or value, which underlie every aspect of life,—conative, intellectual, æsthetic, moral and religious,—but are wholly foreign to the mechanical scheme of natural science. If the Realm of Nature which that scheme symbolises is subservient to the Realm of Ends, it has a meaning: as an absolute mechanism it is meaningless. But if nature is thus subservient, its direction and control by free agents are contingent to it.

"Contingency and freedom of the will . . . ," Professor Ritchie continued, "prepare us to expect a system of pluralism, like that which Professor James seems to favour. . . . A God who is only one among other first causes and independent substances is at the most *primus inter pares*; and the universe in which these substances exist is either a universe of chance (as in Democritean atomism) or is pervaded by some spiritual principle supreme over this limited Deity." The important problem of the One and the Many which Professor Ritchie has here raised lies beyond the demurrer of Naturalism and Agnosticism, to which the present discussion has been confined. But the conclusion, to which I think we have been led, would be almost worthless if it foreclosed the subsequent discussion by such a disjunction as Professor Ritchie lays down. Pure chance in the Democritean sense, we, of course, reject equally with the blind necessity of the mechanical theory. The serious question then is whether the contingency due to the freedom of the Many reduces God to one among the rest, and requires an Absolute

[1] Cf. above, pp. 175 ff., pp. 461 ff. In addition to Windelband's admirable address there cited, I may now refer to Rickert's *Kulturwissenschaft und Naturwissenschaft*, 1899, and to his longer work, *Die Grenzen der naturwissenschaftlichen Begriffsbildung: eine logische Einleitung in die historischen Wissenschaften*, 1902, especially pp. 416-8.

beyond. I quite admit that there is still much to do in differentiating the conception of God, to which experience directly leads, from the conception of the Absolute which belongs entirely to philosophical speculation. This, as part of the whole problem of the One and the Many, will, I believe,—as a brilliant French writer has already said [1]—be *the* problem of the twentieth century; and it is already in the air. Without attempting to anticipate that discussion here we may at least say that a principle which resolves the freedom of the Many into their own private illusion, and so reduces divine government to an empty make-believe, in no sense deserves to be called spiritual. If divine government is a reality, our wills must be ours, though 'we know not how,' and yet God must be veritably supreme. A philosophy of the Absolute incompatible with these positions may fairly be suspected of having over-reached itself.

[1] E. Boirac, *L'Idée du Phénomène*, 1894, p. 247.

INDEX

THE END

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